

# PRELIMINARY DRAINAGE REPORT

February 7, 2019

Revised: July 27, 2020

## Palmeraie Phase 2

Town of Paradise Valley/  
City of Scottsdale

Prepared for:

**Five Star Development**  
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Job #:1-01-0268901



# **PRELIMINARY DRAINAGE REPORT**

## **FOR**

## **PALMERAIE - PHASE 2**

**Town of Paradise Valley &  
City of Scottsdale, Arizona**

February 7, 2019

1<sup>st</sup> Revision: March 17, 2020

2<sup>nd</sup> Revision: July 27, 2020

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7-ZN-2016#2  
8/11/2020

**PRELIMINARY DRAINAGE REPORT****PALMERAIE – PHASE 2****TABLE OF CONTENTS**

<b>1.0 INTRODUCTION.....</b>	<b>1</b>
<b>1.1 Scope .....</b>	<b>1</b>
<b>1.2 Regulatory Jurisdiction.....</b>	<b>1</b>
<b>2.0 LOCATION &amp; SITE DESCRIPTION.....</b>	<b>2</b>
<b>3.0 PROPOSED DEVELOPMENT .....</b>	<b>2</b>
<b>4.0 FLOOD ZONE INFORMATION.....</b>	<b>2</b>
<b>5.0 OFF-SITE HYDROLOGY .....</b>	<b>3</b>
<b>5.1 Background/Existing Off-site Flow Management .....</b>	<b>3</b>
<b>6.0 MANAGEMENT OF ON-SITE RUNOFF .....</b>	<b>4</b>
<b>6.1 On-Site Hydrology.....</b>	<b>5</b>
<b>6.2 On-Site Runoff Management Plan .....</b>	<b>5</b>
<b>7.0 STORM WATER POLLUTION PREVENTION PLAN.....</b>	<b>6</b>
<b>8.0 SUMMARY AND CONCLUSIONS.....</b>	<b>6</b>
<b>9.0 REFERENCES .....</b>	<b>8</b>



## **Appendices**

- Appendix A Ritz Carlton Resort Master Drainage Report Addendum Excerpts
- Appendix B On-Site Hydrology
- Appendix C Hydrodynamic Seperator Specifications and Details
- Appendix D StormCAD Results
- Appendix E Preliminary Grading & Drainage Plans

## **Figures**

- Figure 1 Vicinity and Location Map
- Figure 2 Flood Insurance Rate Map (FIRM)
- Figure 3 Phase Map

## **Plates**

- Plate 1 Proposed Conditions Drainage Map
- Plate 2 Existing Conditions Drainage Map



## 1.0 INTRODUCTION

### 1.1 SCOPE

Coe & Van Loo Consultants, Inc. (CVL) has been contracted by Five Star Development, Inc. to provide engineering services in support of the proposed Ritz-Carlton Palmeraie Phase 2 (the site), also known as Parcel E1. Please see Figure 1 for the Vicinity and Location Map. The purpose of this report is to provide hydrologic analysis for the proposed development. In addition, this report addresses off-site drainage, on-site drainage, and storm-water storage requirements, and conforms to the drainage ideology proposed in the *Master Drainage Report for Ritz Carlton Resort*, June, 2017.

This report is focused on providing preliminary design information, evaluation and analysis for statistical flood events up to and including the 100-year frequency flood. The scope of this assessment does not include, neither did CVL's client request that, evaluation of storm-water runoff resulting from events exceeding the 100-year storm. Hence, it should be noted that a storm event exceeding the 100-year frequency may cause or create the risk of greater flood impact than is addressed and presented in this assessment.

The procedures used herein are derived from, and performed with, currently accepted engineering methodologies and practices. Additionally, the criteria for this evaluation are designed to conform to currently applicable ordinances, regulations and policies as set forth by the Town of Paradise Valley and Maricopa County.

### 1.2 REGULATORY JURISDICTION

The development is designed to meet the City of Scottsdale Design Standards and Policies Manual (DSPM) [1], as well as the Town of Paradise Valley drainage requirements [2], in accordance with the Maricopa County drainage requirements as stated in the Flood Control District of Maricopa County (FCDMC), Drainage Design Manuals for Maricopa County, Arizona, Volume I, Hydrology [3], Volume II, Hydraulics [4], and Drainage Policies and Standards Manual for Maricopa County, Arizona [5].

## 2.0 LOCATION & SITE DESCRIPTION

The site consists of approximately 12 acres located on the border of the Town of Paradise Valley and the City of Scottsdale. The western portion of the site is located within the Town of Paradise Valley. The eastern portion of the site is located within the City of Scottsdale. The site is bordered on the north by Indian Bend Road, on the south by Phase 1, on the west by Palmeraie Boulevard, and on the east by Scottsdale Road. Furthermore, the site is primarily located in Section 10, Township 2 North, Range 4 East of the Gila and Salt River Base and Meridian, Maricopa County, Arizona (See Figure 1 – Vicinity and Location Map).

The site is currently an infill area, consisting of empty desert land surrounded by developed properties. This site slopes generally to the northeast at a slope of 1 percent towards the corner of Scottsdale Road and Indian Bend Road, see Plate 2.

## 3.0 PROPOSED DEVELOPMENT

The proposed development for the onsite improvement plans consist of a shopping center with associated buildings, above and underground parking and the associated infrastructure. Runoff will be drained to roof drains or catch basins and then conveyed to the main channel at the northeast corner of the site (see Drainage Map in Plate 1). Runoff will be treated for first flush requirements before draining into channel.

## 4.0 FLOOD ZONE INFORMATION

The Maricopa County, Arizona and Incorporated Areas Flood Insurance Rate Map (FIRM), panel number 04013C1770L, Map Revised October 16, 2013 [6], indicate the site falls within Zone D

Zone D is defined by FEMA as:

“The Zone D designation is used for areas where there are possible but undetermined flood hazards, as no analysis of flood hazards has been conducted. The Zone D designation is also used when a community incorporates portions of another community’s area where no map has been prepared.”

Refer to Figure 2 for a copy of the Flood Insurance Rate Map (FIRM).

## 5.0 OFF-SITE HYDROLOGY

### 5.1 BACKGROUND/EXISTING OFF-SITE FLOW MANAGEMENT

The main channel extending from Mockingbird Lane to Scottsdale Road (see figure below) conveys off-site flow safely through and around the site. The portion of the main channel that extends along the northern boundary of the Palmeriae site is an interim condition. This portion of the channel will become a box stormdrain prior to the development of Palmeriae.

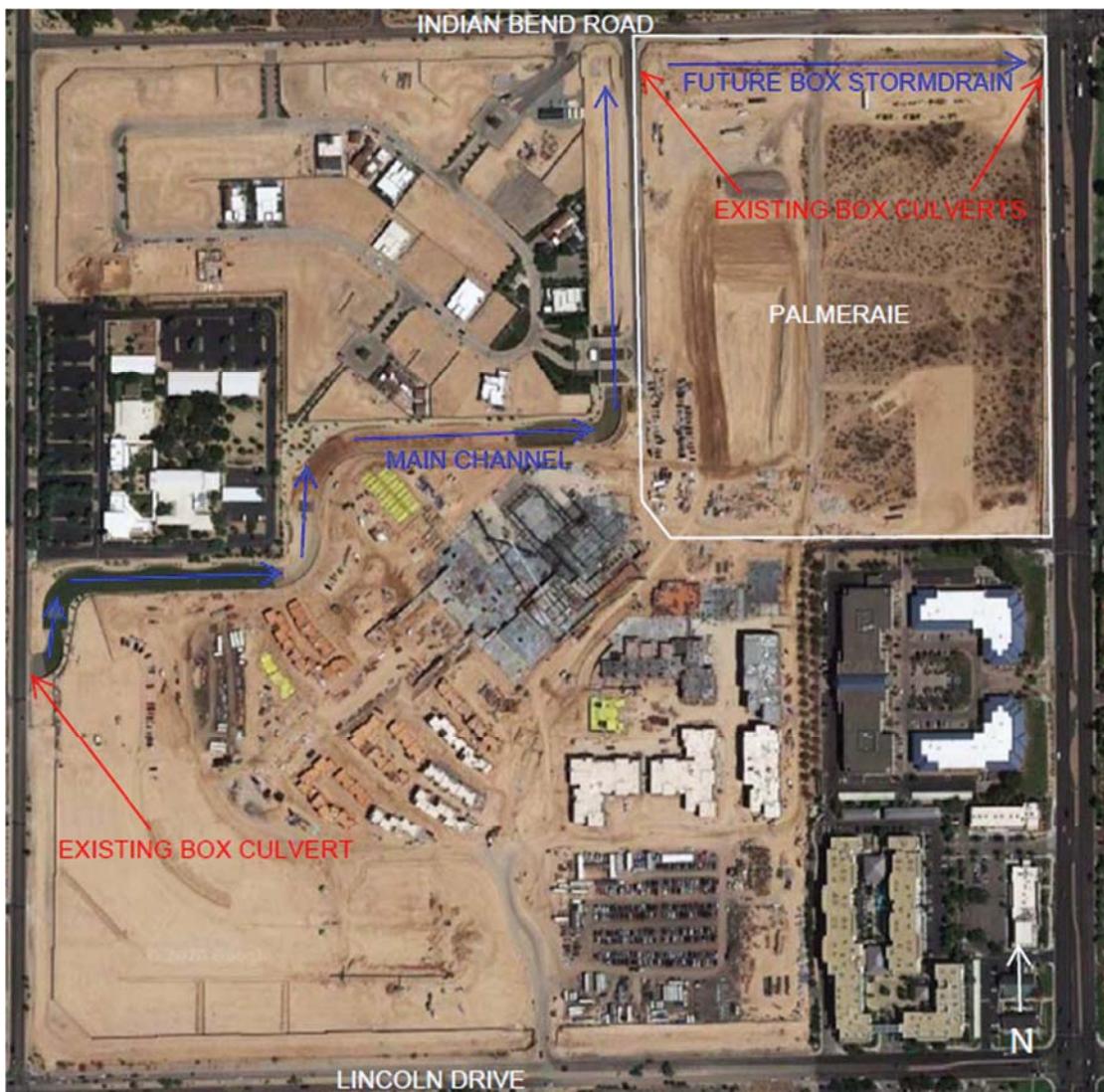


Figure 5.1 - Ritz Carlton Resort Off-site Flows Routed Around Palmeriae

The future condition box stormdrain will be built to the same inverts as the interim channel. Per the *Master Drainage Report for Ritz Carlton Resort*, June, 2017 [7], the proposed box stormdrain was originally sized with 3-10'x5'; however, the design has been modified to 2-12'x6' and still functions. See Appendix D for a StormCAD analysis of the future box stormdrain. Off-site flows from the west will not impact the Palmerae site due to the main channel/future box stormdrain.

The existing Spectrum development, south of the site, meters stormwater from retention basins to a 24-inch pipe and ditch beginning near the southeast corner of the Palmerae (see Figures 5.2 and 5.3). Currently, a small drainage ditch along the eastern boundary of the Palmerae site meters flow from the Spectrum site to the existing box culvert at the southwest



**Figure 5.2 - 19"x30" Elliptical Stormdrain Outfall  
(Spectrum development in background)**

corner of Scottsdale Road and Indian Bend Road. This existing drainage channel will be replaced with a 24-inch pipe to maintain current conditions. The existing outfall from the Spectrum development is an 18-inch x 30-inch elliptical pipe at a 0.2% slope. The proposed pipe is a 24-inch pipe at a 0.3% slope.



**Figure 5.3 - Existing ditch on west side of Scottsdale Road  
(looking north)**

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Calculations and design of this pipe will be included in the Final Drainage Report.

## 6.0 MANAGEMENT OF ON-SITE RUNOFF

### 6.1 ON-SITE HYDROLOGY

The on-site hydrology is based on the Rational Method in accordance with the City of Scottsdale [1], Town of Paradise Valley [2] and Flood Control District of Maricopa County Drainage Design Manual, Volume I, Hydrology [3]. The drainage sub-basins and on-site delineations are based on the layout and preliminary grading and drainage plans. Runoff coefficients of 0.80 and 0.86 for the 10- and 100-year storm frequencies, respectively, were selected from DPSM Figure 4-1.5 for ‘Commercial & Industrial Areas’ [1]. Rainfall data was obtained from NOAA Atlas 14. Times of concentration and the 10-year and 100-year intensities are based on [4]. Peak flow calculations and rainfall data can be found in Appendix B.

### 6.2 ON-SITE RUNOFF MANAGEMENT PLAN

Site runoff will be collected by catch basins and roof drains throughout the site. A stormdrain pipe system will then drain the runoff via a connection to the proposed box stormdrain at the northeast corner of the site. Catch basin inlet sizes and stormdrain pipe will be sized to convey the 10-year and 100-year peak flows.

Per an agreement with Town of Paradise Valley and City of Scottsdale, the 100-year, 2-hour requirement as listed in the City of Scottsdale DSMP Section 4-1 A [1] has been waived in exchange for the already paid “in-lieu” fee. Additionally, the first flush must be treated prior to draining to the box stormdrain that will replace the interim main channel portion on the north side of Palmeraie (see Section 5.1). A hydrodynamic separator will treat the site’s stormwater first flush runoff.

The hydrodynamic separator has been sized for the equivalent first flush flow. The first flush flow was calculated by using an intensity of 0.50 in/hr, C value of 0.86 and the total area of Palmeraie and the portion of Spectrum Drive. The first flush flow was calculated as 6.2 cfs based on the City of Phoenix [8] minimum First Flush treatment discharge equation; see Appendix B for the calculation. Once the separator capacity is filled by the first flush flow, it is able to bypass the 100-year peak flow by utilizing the stormdrain pipe to prevent any backwater issues. Therefore, the total flowrate capacity will depend on the properties of the stormdrain pipe. See Appendix C for the separator specifications and details and Appendix D for the stormdrain calculations showing pipe capacity.

Construction for Phase 2 of this project will follow construction of Phase 1. Therefore, stormwater runoff from Palmeraie Phase 1 was accounted for in the stormdrain design. The proposed Palmeraie stormdrain system will collect and convey runoff from a portion of Spectrum Drive as well. The stormdrain system has been designed assuming both Phase 1 and Phase 2 as fully developed, and is included in Appendix D.

Drainage easements will be provided for watercourses with a 100-year peak discharge rate of 25 cfs or greater. A time of concentration analysis on the Ritz Carlton site was completed in the Ritz Carlton Master Drainage Report Addendum [7]. The reason for this analysis is to prove that there is no tailwater condition when tying into the main channel due to the vast difference in time to peak of approximately 15 minutes and 4.82 hours for on-site and off-site flows, respectively. See Appendix A for excerpts from [7].

## 7.0 STORM WATER POLLUTION PREVENTION PLAN

During final engineering design, the Storm Water Pollution Prevention Plan (SWPPP) will be prepared and submitted for approval.

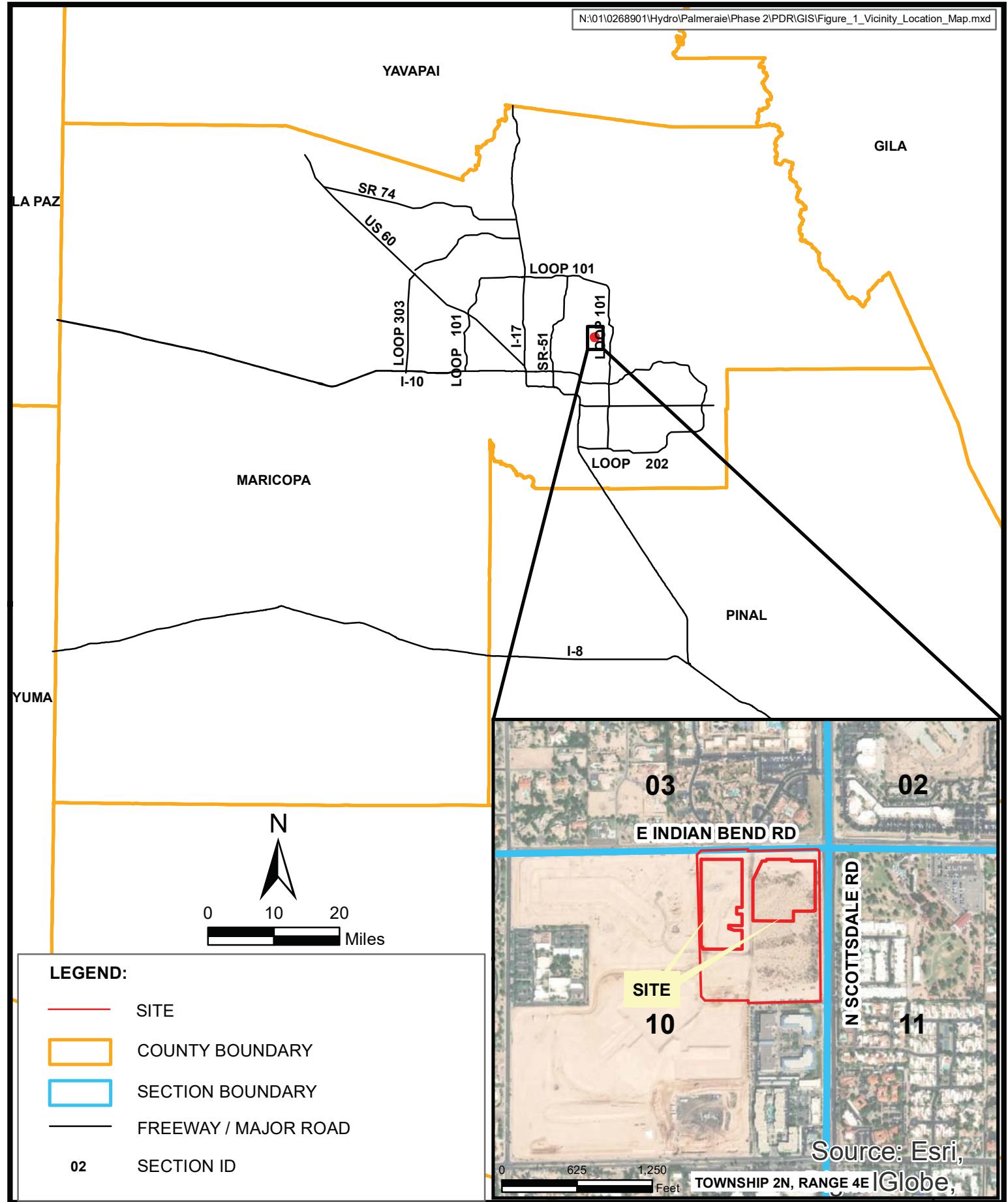
## 8.0 SUMMARY AND CONCLUSIONS

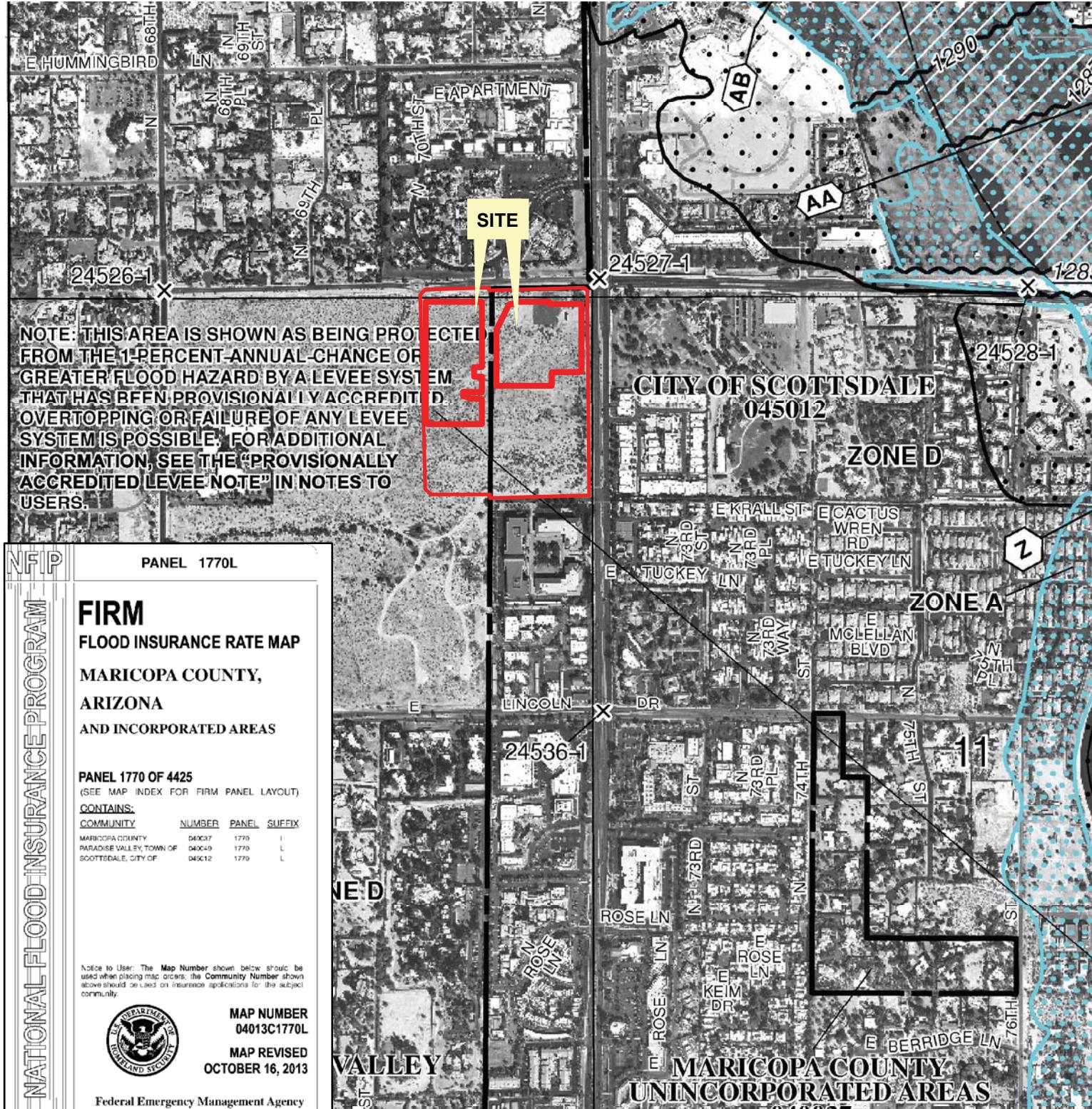
1. A hydrodynamic separator will be used to treat first flush runoff before draining to the outfall.
2. All finished floor elevations will be at least 14 inches above the lowest drainage outfall for the lot.
3. Off-site flows from the west are conveyed around the site by the main channel to the site's ultimate outfall at the southwest corner of Scottsdale Road and Indian Bend Road. A box stormdrain will replace the interim main channel portion running along the northern boundary of the site.
4. The Spectrum will continue to meter retention basin flow along the eastern property boundary in a 24" pipe that will connect to the proposed box stormdrain at the southwest corner of Scottsdale Road and Indian Bend Road.
5. According to the FIRM panel number 04013C1770L, Map Revised: October 16, 2013, the site is located within a Zone D.
6. The preliminary stormdrain system has been designed assuming both Phase 1 and Phase 2 as fully developed.

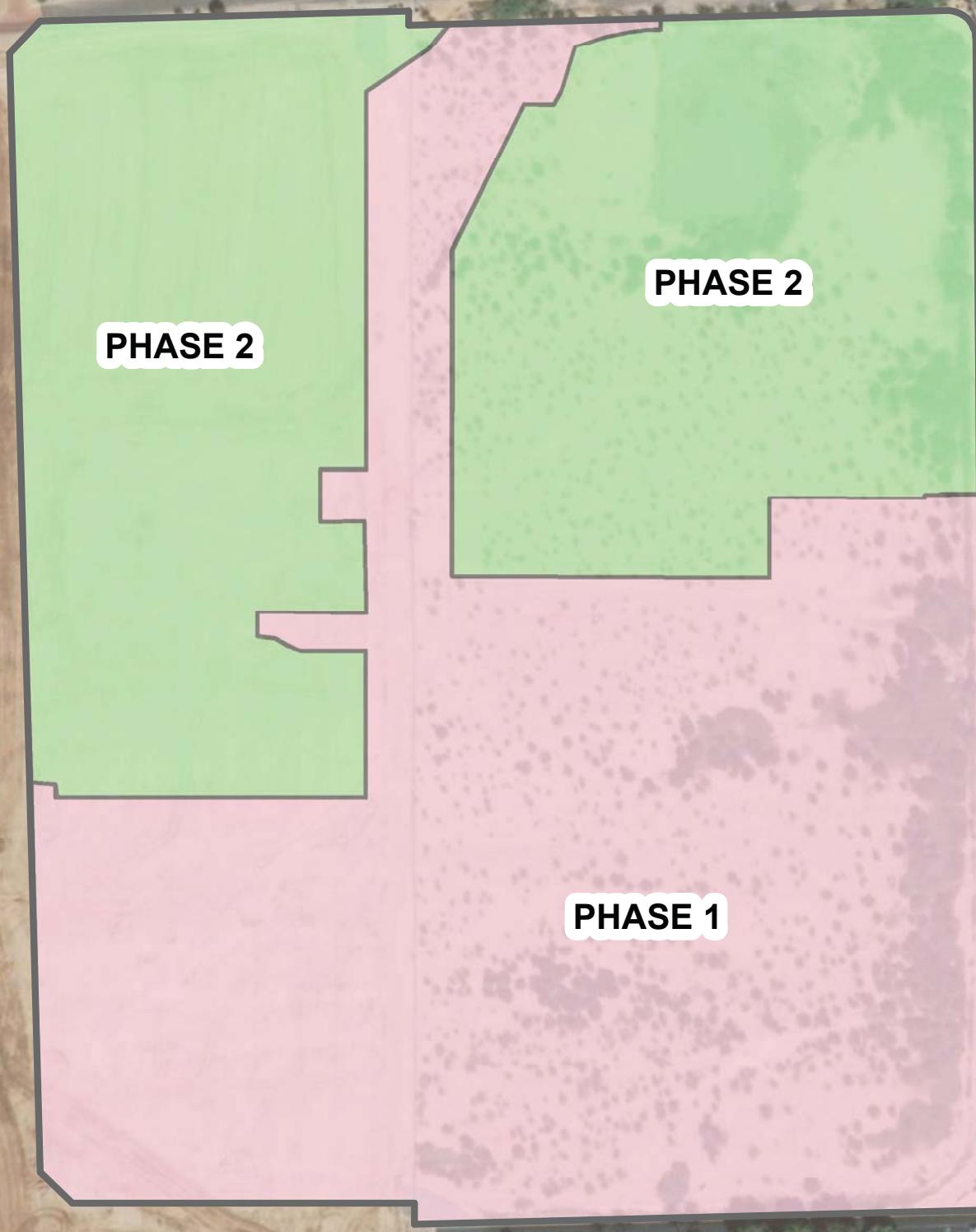
## 9.0 REFERENCES

- [1] City of Scottsdale, "Design Policies and Standards Manual," 2010.
- [2] Town of Paradise Valley, "Paradise Valley Storm Water Manual".
- [3] Flood Control District of Maricopa County, "Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology," Revised December 14, 2018.
- [4] Flood Control District of Maricopa County, Arizona, "Drainage Design Manual for Maricopa County, Volume II, Hydraulics," Revised December 14, 2018.
- [5] Flood Control District of Maricopa County, "Drainage Policies and Standards," Revised August 22, 2018.
- [6] Federal Emergency Management Agency (FEMA), "National Flood Insurance Program, Flood Insurance Rate Map, Maricopa County, Arizona and Incorporated Areas, Panel Numbers 04013C2230L," Revised October 16, 2013.
- [7] CVL Consultants, Inc., "Ritz Carlton Resort Master Drainage Report Addendum," Town of Paradise Valley, November 3, 2016.
- [8] City of Phoenix, "Storm Water Policies and Standards, 3rd Edition," December 2013.

# **FIGURES**







Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



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**PALMERAIE**

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**PHASE MAP**

7-ZN-2016#2  
8/11/2020

## **APPENDICES**

## **APPENDIX A**

# **Ritz Carlton Resort Master Drainage Report Addendum Excerpts (Reference 7)**

# MASTER DRAINAGE REPORT ADDENDUM

November 3, 2016

## Ritz Carlton Resort

Town of Paradise Valley, AZ

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### Five Star Development

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# **MASTER DRAINAGE REPORT ADDENDUM**

## **RITZ CARLTON RESORT**

### **TOWN OF PARADISE VALLEY, ARIZONA**

**November 3, 2016**



*Prepared for:*

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7-ZN-2016#2  
8/11/2020

# Master Drainage Report Addendum Ritz Carlton

## TABLE OF CONTENTS

<b>1.0 INTRODUCTION.....</b>	<b>2</b>
<b>1.1 Scope .....</b>	<b>2</b>
<b>1.2 Regulatory Jurisdiction.....</b>	<b>2</b>
<b>2.0 LOCATION.....</b>	<b>2</b>
<b>5.0 MANAGEMENT OF OFF-SITE RUNOFF .....</b>	<b>3</b>
<b>5.4 Outfall Conditions .....</b>	<b>3</b>
<b>5.4.1 Background and Assumptions .....</b>	<b>3</b>
<b>5.4.2 Modeling.....</b>	<b>3</b>
<b>7.0 MANAGEMENT OF ON-SITE RUNOFF .....</b>	<b>7</b>
<b>7.1 On-site Hydrology .....</b>	<b>7</b>
<b>7.2 On-site Runoff Management Plan .....</b>	<b>7</b>
<b>10.0 SUMMARY AND CONCLUSIONS.....</b>	<b>7</b>
<b>11.0 REFERENCES .....</b>	<b>8</b>

### Figures

- Figure 1     Location and Vicinity Map  
Figure 2     Flood Insurance Rate Map (FIRM)

### Appendices

- Appendix F     Retention Basin Volumes  
Appendix L     Outfall Conditions

### Plates

- Plate 1     Drainage Map  
Plate 2     Ritz Phasing

- CD**           Electronic Files



## 5.0 MANAGEMENT OF OFF-SITE RUNOFF

### 5.4 OUTFALL CONDITIONS

#### 5.4.1 BACKGROUND AND ASSUMPTIONS

The outfall to the proposed main drainage channel is the McCormick-Stillman Railroad Park and channel adjacent to the Seville Plaza along the north side of Indian Bend Road. Section 5.3.1 describes the proposed box stormdrain and connection to the existing box culvert under Scottsdale Road. The outfall to the proposed Lincoln Drive channel (Section 5.3.2) is a 72" stormdrain extending east from the 90" stormdrain to the Arizona Canal. Town review comments on the outfall were discussed in a meeting on January 19<sup>th</sup>, 2016. This led to coordination with the City of Scottsdale to determine addressing those concerns. City concerns and other details included:

- Capacity of the 72" stormdrain in Lincoln Drive
- Capacity of the railroad park and Seville Plaza channels
- Overtopping within the railroad park
- Potential flooding downstream east of the railroad park
- Total flow conditions at the railroad park outfall to include both offsite flows routed through the Ritz site combined with any onsite flows that would fill and overtop the 100-year, 2-hour retention basins by the 100-year, 6-hour event
- Potential solutions for mitigating overtopping flows in the railroad channel to maximize use of the high-capacity Seville channel
- Flood mitigation benefits of the Ritz~Carlton development

#### 5.4.2 MODELING

Per City request, an outfall analysis was performed to determine the benefits and potential adverse impacts due to post-development flows exiting the Ritz site. In order to characterize the outflow conditions, several analyses were performed:

**HEC-1** – A HEC-1 analysis was performed for the Ritz site. The model encompasses only the Ritz site. The model represents the post-developed conditions, accounts for those portions of the site that will contribute to the outfall in question and also accounts for first flush retention to be provided in the site. The 100-year, 6-hour storm, which governs the watershed, was used for

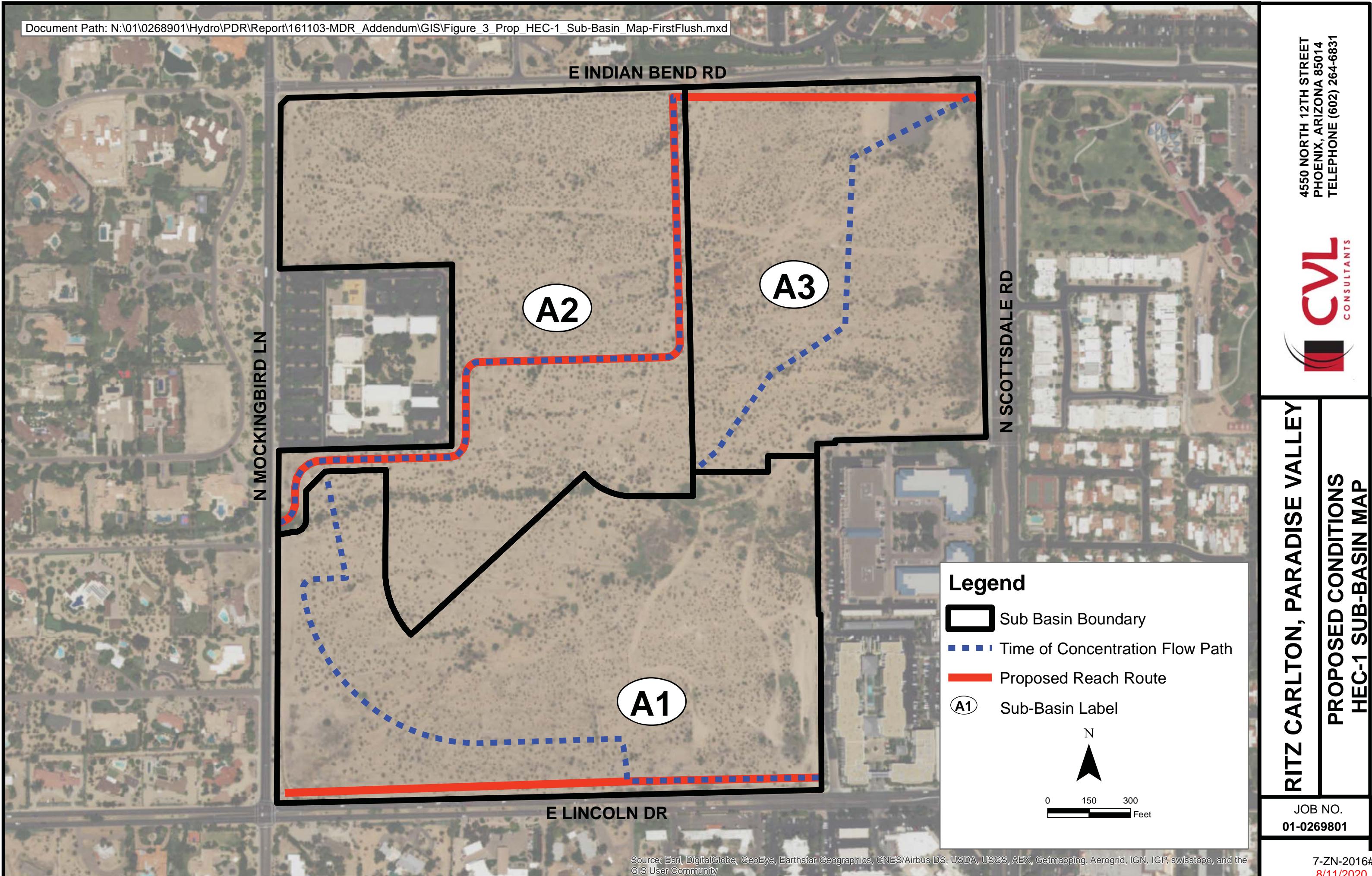
modeling. Additionally, the inflow hydrographs from XP2D (peak flow 764 cfs and 124 cfs) were routed in the HEC-1 model and combined with the onsite hydrographs. A flow pattern comparison to the LIBW ADMS [7] indicates:

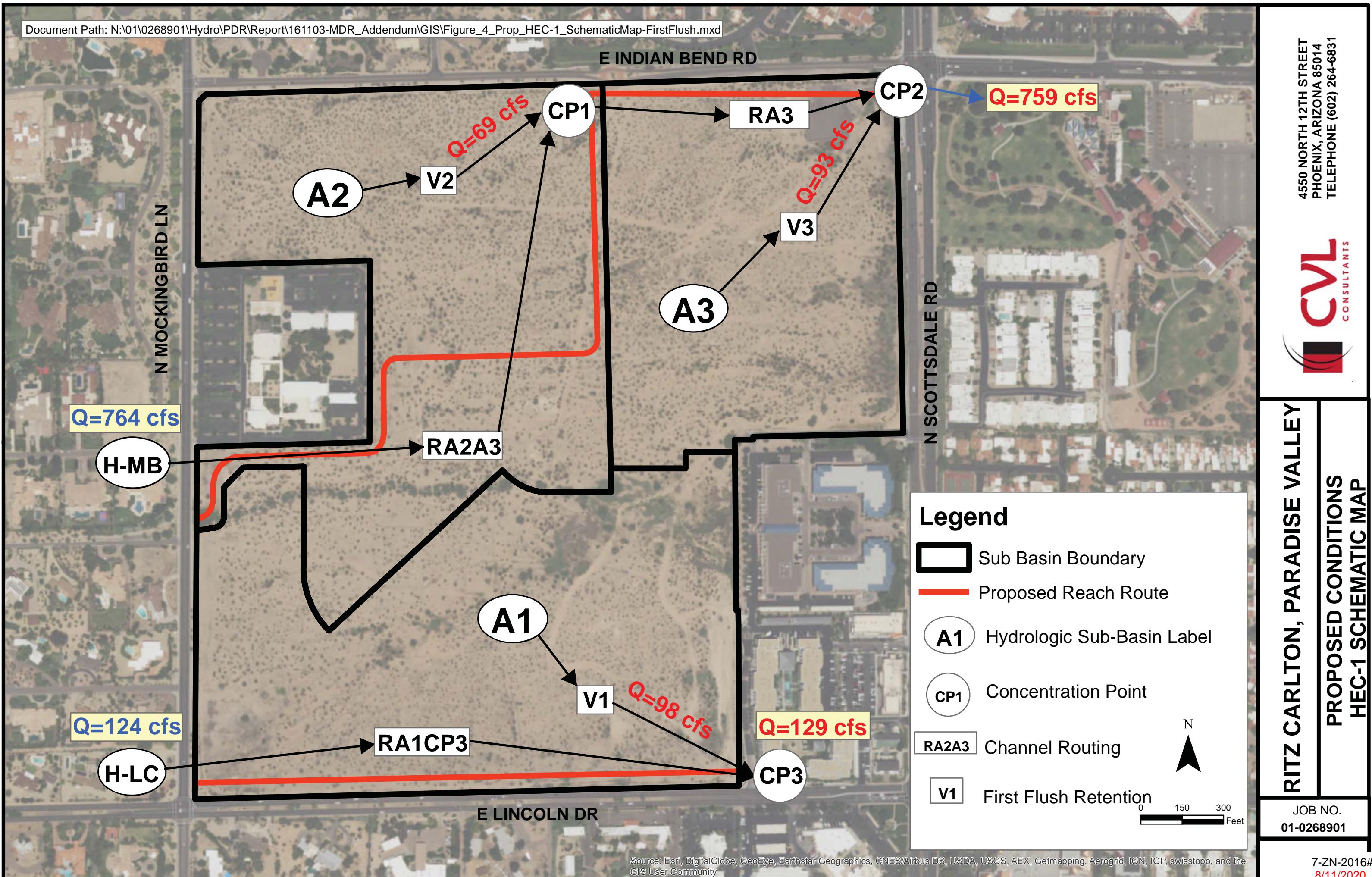
- $Q_{100}$  flows leaving the northern boundary of the site are primarily comprised of flows overtopping Mockingbird Lane or generated onsite. It is assumed that these flows are represented in the peak flows crossing the western site boundary (764 cfs).
- $Q_{100}$  flows entering along the southern boundary of the site (124 cfs) will be contained in the proposed Lincoln Drive channel and routed to the 90" RGRCP stormdrain. It is assumed that these flows would not contribute to the outfall at the railroad park.
- $Q_{100}$  flows entering the site along the entire western boundary, will be intercepted along Mockingbird Lane, conveyed to the proposed main channel and routed through the site to the outfall at the railroad park.

The HEC-1 model was created using DDMS-W 4.8.2 (soils, landuse). Underground retention storage data was developed for each subbasin based on retention volumes provided (see Appendix F, First Flush Retention Volume Calculations).

HEC-1 model results show that most of the 100-yr, 6-hr onsite volumes are not contained in the proposed first flush basins. Time to peak results in the HEC-1 summary indicate that the retention basins are filled, the peak flows pass over but do not coincide with the offsite peak flows. Attenuation of the XP2D offsite hydrograph occurs during Normal Depth routing from Mockingbird Lane to the railroad park. The resulting total 100-year post-development flow at the outfall is 759 cfs. See Appendix L for input parameters and results.

**HEC-RAS** - A HEC-RAS 4.1.0 analysis was performed for a reach delineated from the outfall of the existing box culvert, through the railroad park, underneath Indian Bend Road, along the Seville Plaza channel and into Indian Bend Wash. The most current mapping data (2-foot contour mapping used in the LIBW ADMS) was obtained from the FCDMC and used to develop the cross-section geometry. Onsite survey and as-built plans were used to code the railroad trestle bridge, box culvert and bridges. Manning's 'n' values were spatially estimated based on land cover and flow depth and delineated using ArcGIS. Offsite peak discharge used was 759 cfs described previously. Ineffective flow areas were applied at anomalies in the channel and at structures where





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\* \*\*\*\*\*

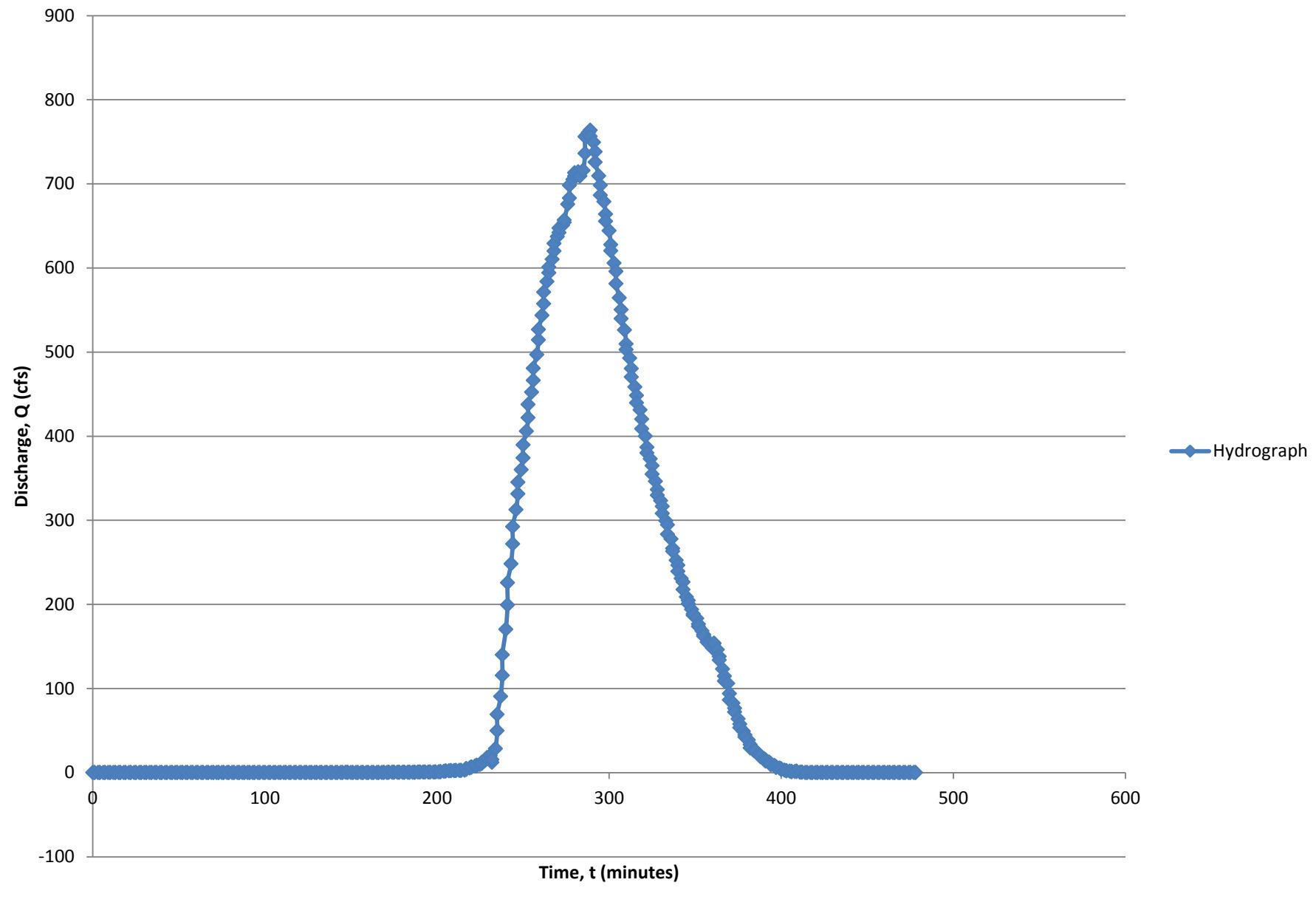
94 KO            OUTPUT CONTROL VARIABLES  
          IPRNT                5     PRINT CONTROL  
          IPLOT                0     PLOT CONTROL  
          QSCAL                0.    HYDROGRAPH PLOT SCALE

1  
RUNOFF SUMMARY  
FLOW IN CUBIC FEET PER SECOND  
TIME IN HOURS, AREA IN SQUARE MILES

+	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
					6-HOUR	24-HOUR	72-HOUR			
HYDROGRAPH AT	A1	98.	4.17		13.	3.	1.	0.07		
ROUTED TO	V1	98.	4.17		9.	2.	1.	0.07		
HYDROGRAPH AT	H-LC	124.	5.00		23.	6.	2.	0.01		
ROUTED TO	RA1CP	116.	5.17		23.	6.	2.	0.01		
2 COMBINED AT	CP3	129.	4.17		32.	8.	3.	0.08		
HYDROGRAPH AT	A2	69.	4.33		11.	3.	1.	0.07		
ROUTED TO	V2	69.	4.33		9.	2.	1.	0.07		
HYDROGRAPH AT	H-MB	764.	4.83		162.	41.	14.	0.01		
ROUTED TO	RA2A3	722.	4.92		162.	41.	14.	0.01		
2 COMBINED AT	CP1	747.	4.83		171.	43.	15.	0.08		
ROUTED TO	RA3	749.	4.92		171.	43.	15.	0.08		
HYDROGRAPH AT	A3	93.	4.17		12.	3.	1.	0.05		
ROUTED TO	V3	93.	4.17		10.	3.	1.	0.05		
2 COMBINED AT	CP2	759.	4.92		181.	46.	16.	0.13		

\*\*\* NORMAL END OF HEC-1 \*\*\*

## MockingBird Ln Inflow Hydrograph



# MockingBird Ln Inflow Hydrograph (XP2D West Flow)

The Maximum Discharge is 763.599 CFS at Time: 289 mins

XPSWMM 2D Results	
Time (min)	Discharge (cfs)
0	0
1	0
1	0
3	0
4	0
4	0
6	0
7	0
7	0
9	0
10	0
10	0
12	0
13	0
13	0
15	0
16	0
16	0
18	0
19	0
19	0
21	0
22	0
22	0
24	0
25	0
25	0
27	0
28	0
28	0
30	0
31	0
31	0
33	0
34	0
34	0
36	0
37	0
37	0

Q100 used for HEC-1 Hydrograph	
Time (min)	Discharge (cfs)
0	0
5	0
10	0
15	0
20	0
25	0
30	0
35	0
40	0
45	0
50	0
55	0.039
60	0.028
65	0.039
70	0.046
75	0.035
80	0.046
85	0.057
90	0.042
95	0.046
100	0.042
105	0.092
110	0.049
115	0.049
120	0.053
125	0.057
130	0.064
135	0.064
140	0.071
145	0.06
150	0.148
155	0.166
160	0.201
165	0.198
170	0.201
175	0.237
180	0.335
185	0.335
190	0.509

# MockingBird Ln Inflow Hydrograph (XP2D West Flow)

The Maximum Discharge is 763.599 CFS at Time: 289 mins

XPSWMM 2D Results	
Time (min)	Discharge (cfs)
39	0
40	0
40	0
42	0
43	0
43	0
45	0
46	0
46	0
48	0
49	0
49	0
51	0.007
52	0.064
52	0.046
54	0.039
55	0.042
55	0.032
57	0.032
58	0.032
58	0.064
60	0.028
61	0.035
61	0.035
63	0.039
64	0.039
64	0.039
66	0.025
67	0.039
67	0.035
69	0.032
70	0.049
70	0.046
72	0.035
73	0.032
73	0.035
75	0.028
76	0.042
76	0.028

Q100 used for HEC-1 Hydrograph	
Time (min)	Discharge (cfs)
195	0.696
200	0.788
205	1.903
210	2.288
215	2.631
220	5.541
225	9.733
230	17.887
235	28.354
240	170.33
245	292.324
250	389.641
255	437.779
260	526.719
265	583.773
270	637.278
275	657.026
280	705.393
285	716.002
290	763.6
295	686.338
300	655.441
305	581.308
310	526.09
315	458.413
320	408.845
325	373.036
330	323.26
335	283.468
340	239.292
345	217.673
350	186.984
355	168.38
360	148.226
365	133.822
370	106.114
375	63.757
380	42.215
385	25.868

# MockingBird Ln Inflow Hydrograph (XP2D West Flow)

The Maximum Discharge is 763.599 CFS at Time: 289 mins

XPSWMM 2D Results	
Time (min)	Discharge (cfs)
78	0.039
79	0.035
79	0.046
81	0.035
82	0
82	0.035
84	0.057
85	0.035
85	0.039
87	0.035
88	0.004
88	0.042
90	0.042
91	0.042
91	0.053
93	0.057
94	0.042
94	0.046
96	0.057
97	0.049
97	0.032
99	0.042
100	0.078
100	0.067
102	0.042
103	0.064
103	0.039
105	0.092
106	0.042
106	0.032
108	0.046
109	0.046
109	0.049
111	0.057
112	0.053
112	0.042
114	0
115	0.057
115	0.049

Q100 used for HEC-1 Hydrograph	
Time (min)	Discharge (cfs)
390	18.982
395	9.468
400	5.28
405	1.73
410	1.162
415	0
420	0
425	0
430	0
435	0
440	0
445	0
450	0
455	0
460	0
465	0
470	0
475	0
480	0

# MockingBird Ln Inflow Hydrograph (XP2D West Flow)

The Maximum Discharge is 763.599 CFS at Time: 289 mins

XPSWMM 2D Results	
Time (min)	Discharge (cfs)
117	0.057
118	0.053
118	0.053
120	0.064
121	0.053
121	0.064
123	0.053
124	0.06
124	0.057
126	0.057
127	0.06
127	0.071
129	0.064
130	0.071
130	0.06
132	0.074
133	0.081
133	0.071
135	0.064
136	0.078
136	0.078
138	0.067
139	0.088
139	0.071
141	0.067
142	0.102
142	0.071
144	0.06
145	0.099
145	0.102
147	0.215
148	0.159
148	0.403
150	0.148
151	0.155
151	0.152
153	0.173
154	0.162
154	0.166

Q100 used for HEC-1 Hydrograph	
Time (min)	Discharge (cfs)

## MockingBird Ln Inflow Hydrograph (XP2D West Flow)

The Maximum Discharge is 763.599 CFS at Time: 289 mins

XPSWMM 2D Results	
Time (min)	Discharge (cfs)
156	0.159
157	0.187
157	0.177
159	0.17
160	0.198
160	0.201
162	0.18
163	0.198
163	0.198
165	0.201
166	0.191
166	0.191
168	0.18
169	0.212
169	0.201
171	0.18
172	0.23
172	0.222
174	0.237
175	0.265
175	0.279
177	0.314
178	0.314
178	0.297
180	0.335
181	0.339
181	0.318
183	0.332
184	0.346
184	0.335
186	0.346
187	0.371
187	0.427
189	0.509
190	0.547
190	0.6
192	0.632
193	0.653
193	0.682

Q100 used for HEC-1 Hydrograph	
Time (min)	Discharge (cfs)

# MockingBird Ln Inflow Hydrograph (XP2D West Flow)

The Maximum Discharge is 763.599 CFS at Time: 289 mins

XPSWMM 2D Results	
Time (min)	Discharge (cfs)
195	0.696
196	0.706
196	0.735
198	0.731
199	0.763
199	0.788
201	0.795
202	0.908
202	1.194
204	1.473
205	1.702
205	1.903
207	2.087
208	2.218
208	2.288
210	2.338
211	2.461
211	2.451
213	2.536
214	2.606
214	2.631
216	2.755
217	3.828
217	4.757
219	5.541
220	6.145
220	6.812
222	7.536
223	7.995
223	8.716
225	9.733
226	10.722
226	12.275
228	14.415
229	16.545
229	17.887
231	20.373
232	12.067
232	15.546

Q100 used for HEC-1 Hydrograph	
Time (min)	Discharge (cfs)

# MockingBird Ln Inflow Hydrograph (XP2D West Flow)

The Maximum Discharge is 763.599 CFS at Time: 289 mins

XPSWMM 2D Results	
Time (min)	Discharge (cfs)
234	28.354
235	49.804
235	69.146
237	90.681
238	115.546
238	140.002
240	170.33
241	199.242
241	225.643
243	248.241
244	271.987
244	292.324
246	312.528
247	331.397
247	345.265
249	359.987
250	374.096
250	389.641
252	405.89
253	421.986
253	437.779
255	452.406
256	466.246
256	480.718
258	497.069
259	514.39
259	526.719
261	543.698
262	557.471
262	571.18
264	583.773
265	594.187
265	601.113
267	610.21
268	619.999
268	629.103
270	637.278
271	642.159
271	647.389

Q100 used for HEC-1 Hydrograph	
Time (min)	Discharge (cfs)

## MockingBird Ln Inflow Hydrograph (XP2D West Flow)

The Maximum Discharge is 763.599 CFS at Time: 289 mins

XPSWMM 2D Results	
Time (min)	Discharge (cfs)
273	650.846
274	654.198
274	657.026
276	675.63
277	683.145
277	698.292
279	705.393
280	709.338
280	713.018
282	714.19
283	709.366
283	709.331
285	716.002
286	736.287
286	756.109
288	760.933
289	763.599
289	756.391
291	749.325
292	738.162
292	725.664
294	709.423
295	698.292
295	686.338
297	678.964
298	664.079
298	655.441
300	644.246
301	627.712
301	620.253
303	605.675
304	595.844
304	581.308
306	564.34
307	550.482
307	539.704
309	526.09
310	509.542
310	502.892

Q100 used for HEC-1 Hydrograph	
Time (min)	Discharge (cfs)

# MockingBird Ln Inflow Hydrograph (XP2D West Flow)

The Maximum Discharge is 763.599 CFS at Time: 289 mins

XPSWMM 2D Results	
Time (min)	Discharge (cfs)
312	492.785
313	480.326
313	470.155
315	458.413
316	448.348
316	439.636
318	431.178
319	420.206
319	408.845
321	400.017
322	386.918
322	380.198
324	373.036
325	364.787
325	354.768
327	346.268
328	336.56
328	329.818
330	323.26
331	316.487
331	308.184
333	299.433
334	294.676
334	283.468
336	277.75
337	266.58
337	263.208
339	252.465
340	246.701
340	239.292
342	230.888
343	226.583
343	217.673
345	208.985
346	204.702
346	200.743
348	194.086
349	188.722
349	186.984

Q100 used for HEC-1 Hydrograph	
Time (min)	Discharge (cfs)

# MockingBird Ln Inflow Hydrograph (XP2D West Flow)

The Maximum Discharge is 763.599 CFS at Time: 289 mins

XPSWMM 2D Results	
Time (min)	Discharge (cfs)
351	183.368
352	176.513
352	173.83
354	168.38
355	164.348
355	162.306
357	155.081
358	155.296
358	153.117
360	148.226
361	153.467
361	153.778
363	146.1
364	137.932
364	133.822
366	123.185
367	114.847
367	108.903
369	106.114
370	94.047
370	86.443
372	82.686
373	76.612
373	72.109
375	63.757
376	57.718
376	53.403
378	49.243
379	44.673
379	42.215
381	38.85
382	33.242
382	29.251
384	26.514
385	25.42
385	25.868
387	21.87
388	20.013
388	18.982

Q100 used for HEC-1 Hydrograph	
Time (min)	Discharge (cfs)

# MockingBird Ln Inflow Hydrograph (XP2D West Flow)

The Maximum Discharge is 763.599 CFS at Time: 289 mins

XPSWMM 2D Results	
Time (min)	Discharge (cfs)
390	16.64
391	15.305
391	13.533
393	12.35
394	10.877
394	9.468
396	8.574
397	7.232
397	5.926
399	5.28
400	4.474
400	3.736
402	3.005
403	2.313
403	2.048
405	1.73
406	1.579
406	0.971
408	1.328
409	1.73
409	1.162
411	0.328
412	0.579
412	0.265
414	0
415	0
415	0
417	0
418	0
418	0
420	0
421	0
421	0
423	0
424	0
424	0
426	0
427	0
427	0

Q100 used for HEC-1 Hydrograph	
Time (min)	Discharge (cfs)

## MockingBird Ln Inflow Hydrograph (XP2D West Flow)

The Maximum Discharge is 763.599 CFS at Time: 289 mins

XPSWMM 2D Results	
Time (min)	Discharge (cfs)
429	0
430	0
430	0
432	0
433	0
433	0
435	0
436	0
436	0
438	0
439	0
439	0
441	0
442	0
442	0
444	0
445	0
445	0
447	0
448	0
448	0
450	0
451	0
451	0
453	0
454	0
454	0
456	0
457	0
457	0
459	0
460	0
460	0
462	0
463	0
463	0
465	0
466	0
466	0

Q100 used for HEC-1 Hydrograph	
Time (min)	Discharge (cfs)

## MockingBird Ln Inflow Hydrograph (XP2D West Flow)

The Maximum Discharge is 763.599 CFS at Time: 289 mins

XPSWMM 2D Results	
Time (min)	Discharge (cfs)
468	0
469	0
469	0
471	0
472	0
472	0
474	0
475	0
475	0
477	0
478	0
478	0

Q100 used for HEC-1 Hydrograph	
Time (min)	Discharge (cfs)

## **APPENDIX B**

### **On-Site Hydrology**



**NOAA Atlas 14, Volume 1, Version 5**  
**Location name: Paradise Valley, Arizona, USA\***  
**Latitude: 33.537°, Longitude: -111.9269°**  
**Elevation: 1302.62 ft\*\***  
 \* source: ESRI Maps  
 \*\* source: USGS



### POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

[PF\\_tabular](#) | [PF\\_graphical](#) | [Maps & aerials](#)

#### PF tabular

<b>PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)<sup>1</sup></b>										
<b>Duration</b>	<b>Average recurrence interval (years)</b>									
	<b>1</b>	<b>2</b>	<b>5</b>	<b>10</b>	<b>25</b>	<b>50</b>	<b>100</b>	<b>200</b>	<b>500</b>	<b>1000</b>
<b>5-min</b>	<b>0.186</b> (0.155-0.228)	<b>0.243</b> (0.204-0.297)	<b>0.329</b> (0.274-0.402)	<b>0.396</b> (0.327-0.481)	<b>0.486</b> (0.395-0.588)	<b>0.555</b> (0.446-0.667)	<b>0.626</b> (0.494-0.751)	<b>0.698</b> (0.541-0.836)	<b>0.794</b> (0.600-0.953)	<b>0.868</b> (0.643-1.04)
<b>10-min</b>	<b>0.283</b> (0.236-0.347)	<b>0.370</b> (0.310-0.453)	<b>0.501</b> (0.417-0.612)	<b>0.603</b> (0.498-0.732)	<b>0.739</b> (0.602-0.894)	<b>0.844</b> (0.679-1.02)	<b>0.952</b> (0.752-1.14)	<b>1.06</b> (0.824-1.27)	<b>1.21</b> (0.914-1.45)	<b>1.32</b> (0.979-1.59)
<b>15-min</b>	<b>0.350</b> (0.293-0.429)	<b>0.458</b> (0.384-0.561)	<b>0.622</b> (0.517-0.758)	<b>0.747</b> (0.618-0.908)	<b>0.916</b> (0.746-1.11)	<b>1.05</b> (0.841-1.26)	<b>1.18</b> (0.932-1.42)	<b>1.32</b> (1.02-1.58)	<b>1.50</b> (1.13-1.80)	<b>1.64</b> (1.21-1.97)
<b>30-min</b>	<b>0.472</b> (0.394-0.578)	<b>0.617</b> (0.518-0.755)	<b>0.837</b> (0.696-1.02)	<b>1.01</b> (0.832-1.22)	<b>1.23</b> (1.00-1.49)	<b>1.41</b> (1.13-1.70)	<b>1.59</b> (1.25-1.91)	<b>1.77</b> (1.38-2.12)	<b>2.02</b> (1.53-2.42)	<b>2.21</b> (1.63-2.65)
<b>60-min</b>	<b>0.584</b> (0.488-0.715)	<b>0.764</b> (0.641-0.935)	<b>1.04</b> (0.862-1.26)	<b>1.25</b> (1.03-1.51)	<b>1.53</b> (1.24-1.85)	<b>1.75</b> (1.40-2.10)	<b>1.97</b> (1.55-2.36)	<b>2.19</b> (1.70-2.63)	<b>2.50</b> (1.89-3.00)	<b>2.73</b> (2.02-3.28)
<b>2-hr</b>	<b>0.679</b> (0.576-0.812)	<b>0.879</b> (0.745-1.06)	<b>1.18</b> (0.991-1.40)	<b>1.40</b> (1.17-1.67)	<b>1.71</b> (1.41-2.03)	<b>1.95</b> (1.59-2.30)	<b>2.19</b> (1.76-2.58)	<b>2.44</b> (1.92-2.87)	<b>2.77</b> (2.13-3.26)	<b>3.03</b> (2.28-3.59)
<b>3-hr</b>	<b>0.747</b> (0.631-0.905)	<b>0.957</b> (0.813-1.17)	<b>1.25</b> (1.06-1.52)	<b>1.49</b> (1.25-1.80)	<b>1.82</b> (1.50-2.18)	<b>2.09</b> (1.69-2.49)	<b>2.36</b> (1.88-2.81)	<b>2.65</b> (2.08-3.15)	<b>3.05</b> (2.31-3.62)	<b>3.36</b> (2.49-4.01)
<b>6-hr</b>	<b>0.899</b> (0.776-1.06)	<b>1.14</b> (0.983-1.35)	<b>1.46</b> (1.25-1.72)	<b>1.71</b> (1.46-2.01)	<b>2.06</b> (1.73-2.40)	<b>2.33</b> (1.93-2.71)	<b>2.61</b> (2.13-3.03)	<b>2.90</b> (2.32-3.37)	<b>3.29</b> (2.57-3.83)	<b>3.60</b> (2.75-4.20)
<b>12-hr</b>	<b>1.00</b> (0.872-1.17)	<b>1.26</b> (1.10-1.48)	<b>1.60</b> (1.39-1.86)	<b>1.86</b> (1.60-2.16)	<b>2.22</b> (1.89-2.57)	<b>2.49</b> (2.10-2.87)	<b>2.77</b> (2.30-3.20)	<b>3.06</b> (2.50-3.53)	<b>3.44</b> (2.74-3.99)	<b>3.74</b> (2.92-4.36)
<b>24-hr</b>	<b>1.19</b> (1.04-1.37)	<b>1.51</b> (1.32-1.74)	<b>1.95</b> (1.71-2.25)	<b>2.30</b> (2.01-2.65)	<b>2.79</b> (2.42-3.21)	<b>3.18</b> (2.74-3.64)	<b>3.58</b> (3.06-4.10)	<b>3.99</b> (3.39-4.58)	<b>4.57</b> (3.83-5.24)	<b>5.03</b> (4.17-5.78)
<b>2-day</b>	<b>1.28</b> (1.13-1.47)	<b>1.64</b> (1.44-1.88)	<b>2.15</b> (1.88-2.46)	<b>2.56</b> (2.23-2.93)	<b>3.13</b> (2.72-3.58)	<b>3.58</b> (3.09-4.10)	<b>4.06</b> (3.48-4.65)	<b>4.56</b> (3.88-5.23)	<b>5.26</b> (4.42-6.04)	<b>5.82</b> (4.84-6.70)
<b>3-day</b>	<b>1.36</b> (1.20-1.56)	<b>1.74</b> (1.53-1.99)	<b>2.29</b> (2.01-2.62)	<b>2.73</b> (2.39-3.12)	<b>3.35</b> (2.91-3.83)	<b>3.85</b> (3.33-4.40)	<b>4.39</b> (3.76-5.01)	<b>4.94</b> (4.20-5.65)	<b>5.73</b> (4.81-6.55)	<b>6.36</b> (5.29-7.30)
<b>4-day</b>	<b>1.44</b> (1.27-1.65)	<b>1.84</b> (1.62-2.11)	<b>2.43</b> (2.13-2.77)	<b>2.91</b> (2.54-3.31)	<b>3.58</b> (3.11-4.08)	<b>4.13</b> (3.56-4.70)	<b>4.71</b> (4.04-5.36)	<b>5.33</b> (4.53-6.08)	<b>6.20</b> (5.21-7.07)	<b>6.91</b> (5.75-7.90)
<b>7-day</b>	<b>1.61</b> (1.41-1.85)	<b>2.06</b> (1.81-2.37)	<b>2.73</b> (2.38-3.12)	<b>3.26</b> (2.84-3.74)	<b>4.03</b> (3.49-4.60)	<b>4.64</b> (3.99-5.30)	<b>5.29</b> (4.52-6.05)	<b>5.99</b> (5.08-6.85)	<b>6.97</b> (5.83-7.97)	<b>7.76</b> (6.43-8.89)
<b>10-day</b>	<b>1.74</b> (1.53-2.00)	<b>2.23</b> (1.96-2.55)	<b>2.95</b> (2.58-3.36)	<b>3.52</b> (3.08-4.01)	<b>4.33</b> (3.76-4.92)	<b>4.98</b> (4.30-5.65)	<b>5.67</b> (4.86-6.44)	<b>6.39</b> (5.44-7.27)	<b>7.41</b> (6.23-8.42)	<b>8.23</b> (6.85-9.36)
<b>20-day</b>	<b>2.15</b> (1.90-2.44)	<b>2.77</b> (2.44-3.14)	<b>3.65</b> (3.22-4.14)	<b>4.33</b> (3.80-4.90)	<b>5.23</b> (4.57-5.92)	<b>5.93</b> (5.16-6.71)	<b>6.64</b> (5.75-7.52)	<b>7.36</b> (6.34-8.35)	<b>8.33</b> (7.12-9.47)	<b>9.08</b> (7.70-10.3)
<b>30-day</b>	<b>2.51</b> (2.21-2.86)	<b>3.23</b> (2.85-3.67)	<b>4.26</b> (3.75-4.83)	<b>5.05</b> (4.43-5.71)	<b>6.10</b> (5.32-6.90)	<b>6.91</b> (6.01-7.81)	<b>7.74</b> (6.70-8.74)	<b>8.59</b> (7.39-9.69)	<b>9.73</b> (8.31-11.0)	<b>10.6</b> (8.99-12.0)
<b>45-day</b>	<b>2.90</b> (2.57-3.28)	<b>3.74</b> (3.30-4.23)	<b>4.93</b> (4.35-5.57)	<b>5.81</b> (5.12-6.56)	<b>6.97</b> (6.12-7.86)	<b>7.84</b> (6.86-8.85)	<b>8.73</b> (7.60-9.86)	<b>9.62</b> (8.33-10.9)	<b>10.8</b> (9.28-12.2)	<b>11.7</b> (9.98-13.3)
<b>60-day</b>	<b>3.20</b> (2.84-3.60)	<b>4.13</b> (3.67-4.65)	<b>5.44</b> (4.82-6.12)	<b>6.38</b> (5.64-7.19)	<b>7.62</b> (6.72-8.57)	<b>8.53</b> (7.50-9.60)	<b>9.45</b> (8.27-10.6)	<b>10.3</b> (9.02-11.7)	<b>11.5</b> (9.99-13.0)	<b>12.4</b> (10.7-14.0)

<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

**NOAA Atlas 14, Volume 1, Version 5****Location name: Paradise Valley, Arizona, USA\*****Latitude: 33.537°, Longitude: -111.9269°****Elevation: 1302.62 ft\*\***

\* source: ESRI Maps

\*\* source: USGS

**POINT PRECIPITATION FREQUENCY ESTIMATES**

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

[PF\\_tabular](#) | [PF\\_graphical](#) | [Maps & aerials](#)
**PF tabular**

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	2.23 (1.86-2.74)	2.92 (2.45-3.56)	3.95 (3.29-4.82)	4.75 (3.92-5.77)	5.83 (4.74-7.06)	6.66 (5.35-8.00)	7.51 (5.93-9.01)	8.38 (6.49-10.0)	9.53 (7.20-11.4)	10.4 (7.72-12.5)
10-min	1.70 (1.42-2.08)	2.22 (1.86-2.72)	3.01 (2.50-3.67)	3.62 (2.99-4.39)	4.43 (3.61-5.36)	5.06 (4.07-6.10)	5.71 (4.51-6.86)	6.37 (4.94-7.63)	7.25 (5.48-8.70)	7.93 (5.87-9.53)
15-min	1.40 (1.17-1.72)	1.83 (1.54-2.24)	2.49 (2.07-3.03)	2.99 (2.47-3.63)	3.66 (2.98-4.44)	4.19 (3.36-5.04)	4.72 (3.73-5.67)	5.27 (4.09-6.31)	6.00 (4.53-7.19)	6.55 (4.86-7.87)
30-min	0.944 (0.788-1.16)	1.23 (1.04-1.51)	1.67 (1.39-2.04)	2.01 (1.66-2.45)	2.47 (2.01-2.99)	2.82 (2.27-3.39)	3.18 (2.51-3.82)	3.55 (2.75-4.25)	4.04 (3.05-4.84)	4.41 (3.27-5.30)
60-min	0.584 (0.488-0.715)	0.764 (0.641-0.935)	1.04 (0.862-1.26)	1.25 (1.03-1.51)	1.53 (1.24-1.85)	1.75 (1.40-2.10)	1.97 (1.55-2.36)	2.19 (1.70-2.63)	2.50 (1.89-3.00)	2.73 (2.02-3.28)
2-hr	0.340 (0.288-0.406)	0.440 (0.372-0.528)	0.588 (0.496-0.701)	0.700 (0.586-0.834)	0.855 (0.706-1.01)	0.972 (0.792-1.15)	1.09 (0.878-1.29)	1.22 (0.959-1.43)	1.38 (1.06-1.63)	1.51 (1.14-1.79)
3-hr	0.249 (0.210-0.301)	0.319 (0.271-0.388)	0.418 (0.353-0.506)	0.497 (0.415-0.598)	0.607 (0.500-0.726)	0.695 (0.564-0.828)	0.787 (0.627-0.937)	0.882 (0.691-1.05)	1.01 (0.771-1.21)	1.12 (0.831-1.34)
6-hr	0.150 (0.130-0.178)	0.190 (0.164-0.225)	0.243 (0.209-0.286)	0.286 (0.243-0.335)	0.344 (0.289-0.401)	0.389 (0.322-0.452)	0.436 (0.356-0.507)	0.484 (0.388-0.563)	0.550 (0.429-0.640)	0.602 (0.459-0.702)
12-hr	0.083 (0.072-0.097)	0.105 (0.091-0.122)	0.133 (0.115-0.154)	0.155 (0.133-0.179)	0.184 (0.157-0.213)	0.207 (0.174-0.238)	0.230 (0.191-0.266)	0.254 (0.207-0.293)	0.285 (0.228-0.331)	0.310 (0.243-0.362)
24-hr	0.049 (0.043-0.057)	0.063 (0.055-0.072)	0.081 (0.071-0.094)	0.096 (0.084-0.110)	0.116 (0.101-0.134)	0.132 (0.114-0.152)	0.149 (0.128-0.171)	0.166 (0.141-0.191)	0.190 (0.160-0.218)	0.209 (0.174-0.241)
2-day	0.027 (0.023-0.031)	0.034 (0.030-0.039)	0.045 (0.039-0.051)	0.053 (0.047-0.061)	0.065 (0.057-0.075)	0.075 (0.064-0.085)	0.085 (0.072-0.097)	0.095 (0.081-0.109)	0.110 (0.092-0.126)	0.121 (0.101-0.140)
3-day	0.019 (0.017-0.022)	0.024 (0.021-0.028)	0.032 (0.028-0.036)	0.038 (0.033-0.043)	0.047 (0.040-0.053)	0.054 (0.046-0.061)	0.061 (0.052-0.070)	0.069 (0.058-0.079)	0.080 (0.067-0.091)	0.088 (0.074-0.101)
4-day	0.015 (0.013-0.017)	0.019 (0.017-0.022)	0.025 (0.022-0.029)	0.030 (0.026-0.035)	0.037 (0.032-0.043)	0.043 (0.037-0.049)	0.049 (0.042-0.056)	0.055 (0.047-0.063)	0.065 (0.054-0.074)	0.072 (0.060-0.082)
7-day	0.010 (0.008-0.011)	0.012 (0.011-0.014)	0.016 (0.014-0.019)	0.019 (0.017-0.022)	0.024 (0.021-0.027)	0.028 (0.024-0.032)	0.032 (0.027-0.036)	0.036 (0.030-0.041)	0.041 (0.035-0.047)	0.046 (0.038-0.053)
10-day	0.007 (0.006-0.008)	0.009 (0.008-0.011)	0.012 (0.011-0.014)	0.015 (0.013-0.017)	0.018 (0.016-0.021)	0.021 (0.018-0.024)	0.024 (0.020-0.027)	0.027 (0.023-0.030)	0.031 (0.026-0.035)	0.034 (0.029-0.039)
20-day	0.004 (0.004-0.005)	0.006 (0.005-0.007)	0.008 (0.007-0.009)	0.009 (0.008-0.010)	0.011 (0.010-0.012)	0.012 (0.011-0.014)	0.014 (0.012-0.016)	0.015 (0.013-0.017)	0.017 (0.015-0.020)	0.019 (0.016-0.022)
30-day	0.003 (0.003-0.004)	0.004 (0.004-0.005)	0.006 (0.005-0.007)	0.007 (0.006-0.008)	0.008 (0.007-0.010)	0.010 (0.008-0.011)	0.011 (0.009-0.012)	0.012 (0.010-0.013)	0.014 (0.012-0.015)	0.015 (0.012-0.017)
45-day	0.003 (0.002-0.003)	0.003 (0.003-0.004)	0.005 (0.004-0.005)	0.005 (0.005-0.006)	0.006 (0.006-0.007)	0.007 (0.006-0.008)	0.008 (0.007-0.009)	0.009 (0.008-0.010)	0.010 (0.009-0.011)	0.011 (0.009-0.012)
60-day	0.002 (0.002-0.003)	0.003 (0.003-0.003)	0.004 (0.003-0.004)	0.004 (0.004-0.005)	0.005 (0.005-0.006)	0.006 (0.005-0.007)	0.007 (0.006-0.007)	0.007 (0.006-0.008)	0.008 (0.007-0.009)	0.009 (0.007-0.010)

<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

[Back to Top](#)

7-ZN-2016#2

8/11/2020

**SUMMARY OF RATIONAL METHOD PEAK FLOW HYDROLOGY  
EXISTING CONDITIONS RITZ CARLTON - PALMERAIE**

Sub-Basin ID	Sub- basin Area (ac)	Water Course Length ft	High Elevation ft	Low Elevation ft	Roughness, Kb	C		i		Tc		Q	
						Weighted Runoff Coefficient		Intensity (in/hr)		Time of Concentration (min)		Peak Flow Rate (cfs)	
						Return Period	Return Period	Return Period	Return Period	Return Period	Return Period	Return Period	Return Period
10-Year	100-Year	10-Year	100-Year	10-Year	100-Year	10-Year	100-Year	10-Year	100-Year	10-Year	100-Year	10-Year	100-Year
EX-1	0.17	32	1309	1308.5	0.0449 (A)	0.36	0.45	4.8	7.6	5	5	0	1
EX-2	2.36	1081	1309.2	1301.4	0.0377 (A)	0.36	0.45	3.5	6.1	11.3	9.2	3	6
EX-3	1.57	627	1307	1301.1	0.0388 (A)	0.36	0.45	4.2	7.2	7.5	6.1	2	5
EX-4	4.81	803	1307.1	1300.4	0.0357 (A)	0.36	0.45	4	6.9	8.6	7	7	15
EX-5	8.61	1322	1309.7	1300.4	0.0342 (A)	0.36	0.45	3.4	5.8	12.1	9.9	11	23
EX-6	2.22	384	1310.7	1304.9	0.0378 (A)	0.36	0.45	4.8	7.6	5	5	4	8
EX-7	0.84	273	1310.7	1306.1	0.0405 (A)	0.36	0.45	4.8	7.6	5	5	1	3
EX-8	4.41	786	1310.7	1299.4	0.036 (A)	0.36	0.45	4.4	7.3	7	5.7	7	15
EX-9	0.92	304	1303.2	1300.3	0.0402 (A)	0.36	0.45	4.8	7.6	5	5	2	3

Reference: Drainage Design Manual for Maricopa County, Hydrology, December 14, 2018

Notes:

$T_c = 11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38}$  (Equation 3.2, Papadakis and Kazan equation, 1987)

L = Length of the longest flow path, miles.

S = Watercourse slope, feet/mile.

$K_b$  = Watershed resistance coefficient =  $m \log_{10}A + b$ , where A= drainage area in acres, m and b values from (Table 3.1).

Q = Peak discharge =  $C \cdot I \cdot A$ , cfs. (Equation 3.1)

i = Average rainfall intensity, in in/hr, lasting for a  $T_c$ . Determined using the I-D-F curve from the NOAA Atlas 14 PRECIPITATION FREQUENCY ESTIMATES

C = Runoff coefficient per Undeveloped Desert Rangeland land use category per Table 3.2.

**RITZ CARLTON - PALMERAIE**  
**First Flush Peak Flow Calculation**

Site ID	Drainage <sup>(1)</sup>		Runoff <sup>(2)</sup> Coefficient <b>C</b>	Rainfall <sup>(3)</sup> Intensity <b>I<sub>FF</sub></b> (in/hr)	Peak <sup>(4)</sup> Flow <b>Q<sub>FF</sub></b> (ft <sup>3</sup> /s)
	Area <b>A</b> (ac)	(ft <sup>2</sup> )			
Palmeriae	29.08	1,266,868	0.86	0.248858	6.2

**Reference:** [1] *City of Phoenix Storm Water Policies and Standards Manual* , December 2013.  
[2] *Drainage Policies and Standards for Maricopa County* , Arizona, August 22, 2018.

**Notes:**

1. Drainage area is for all of Palmeriae site plus portion of Spectrum Drive (see Plate 1).
2. Runoff coefficient per Figure 4-1.5 of [1].

C = 0.86 for 100-yr Return Period for "Commercial & Industrial Areas"

3. I<sub>FF</sub> = Rainfall intensity for calculating first flush peak flow for any storm event duration to be treated by Aqua-Swirl™ system [1].

$$I_{FF} = (P_{FF}/P_{100-yr, 2-hr}) * I_{100-yr, 2-hr}$$

where P<sub>FF</sub> = 0.5 in

P<sub>100-yr, 2-hr</sub> = 2.19 in

I<sub>100-yr, 2-hr</sub> = 1.09 in/hr

4. Q<sub>FF</sub> = C \* I \* A (cfs).

## **APPENDIX C**

### **Hydrodynamic Separator Specification and Details**

# AQUA-SWIRL

## HYDRODYNAMIC SEPARATION

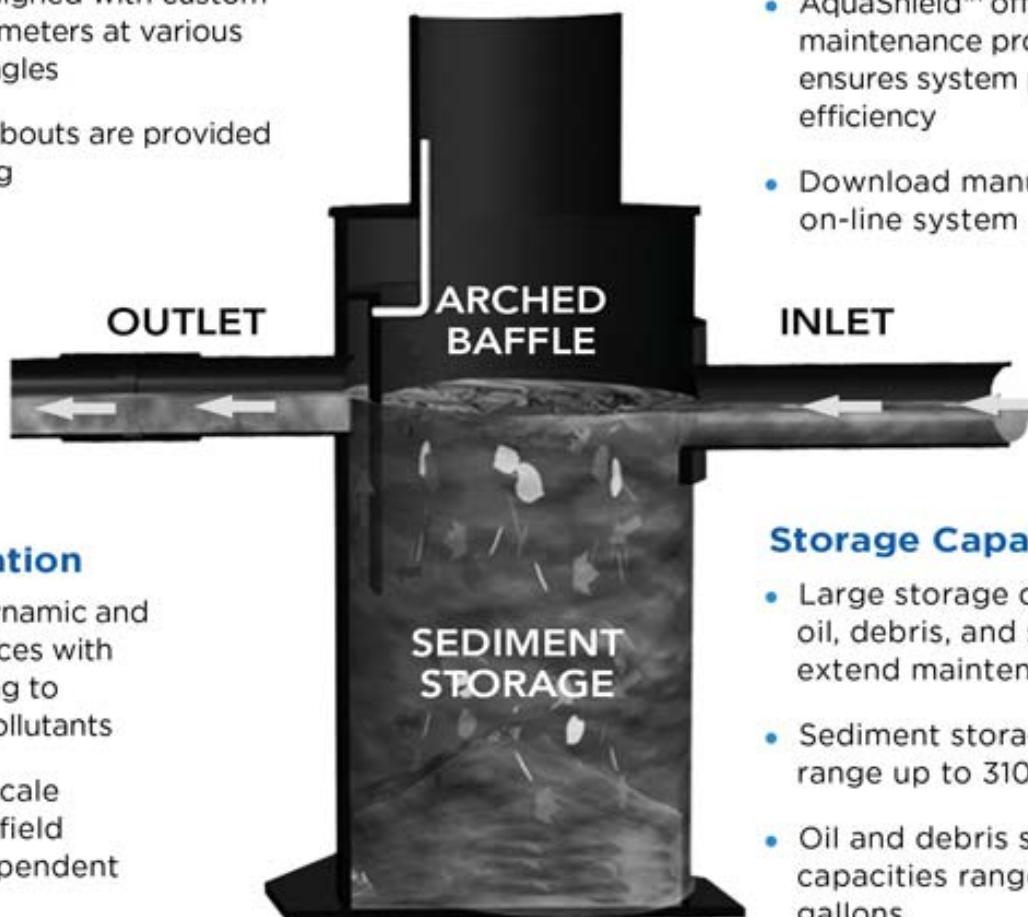


INNOVATING GOOD CLEAN WATER

# AQUA-SWIRL™

## Pipe Connections

- Systems are designed with custom inlet / outlet diameters at various configuration angles
- Inlet / outlet stubouts are provided for easy coupling



## Vortex Separation

- Utilizes hydrodynamic and gravitational forces with quiescent settling to remove gross pollutants
- Extensive full-scale laboratory and field testing by independent third parties

## Inspection & Maintenance

- AquaShield™ offers an extensive maintenance program that ensures system performance efficiency
- Download manuals from the on-line system catalog

INLET

## Storage Capacities

- Large storage capacities for oil, debris, and sediment extend maintenance cycles
- Sediment storage capacities range up to 310 ft<sup>3</sup>
- Oil and debris storage capacities range up to 1986 gallons

## Bypass

- Systems are designed to treat water quality flow rates and bypass peak storm events
- Internal and external bypass configurations are available

## Installation Benefits

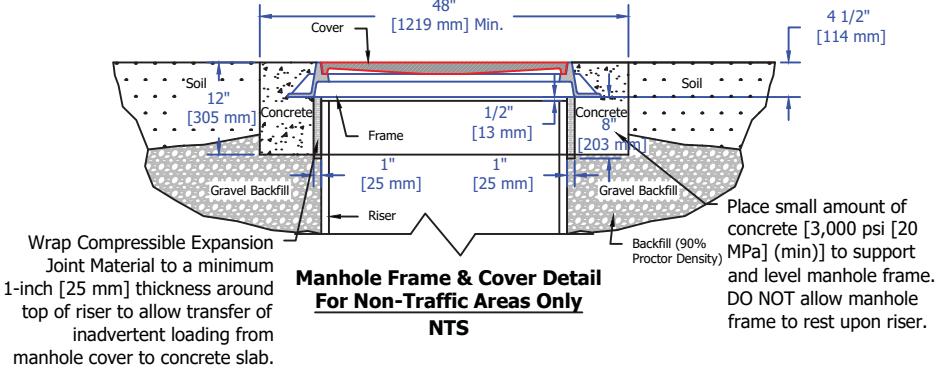
- Quick and simple installation, resulting in measurable project cost savings
- H2O loading capabilities
- Small footprint design reduces excavation costs
- Lightweight and durable construction
- Lifting supports & cables provided

## Aqua-Swirl™ System

- Provides customized solutions for project specific requirements
- Systems designed for specific water quality treatment flows
- Modular sizes from 2.5 - 13 ft diameters with attached risers to finish grade
- On-line project and system design tool at <http://pda.aquashieldinc.com>

## Aqua-Swirl Polymer Coated Steel (PCS) Stormwater Treatment System

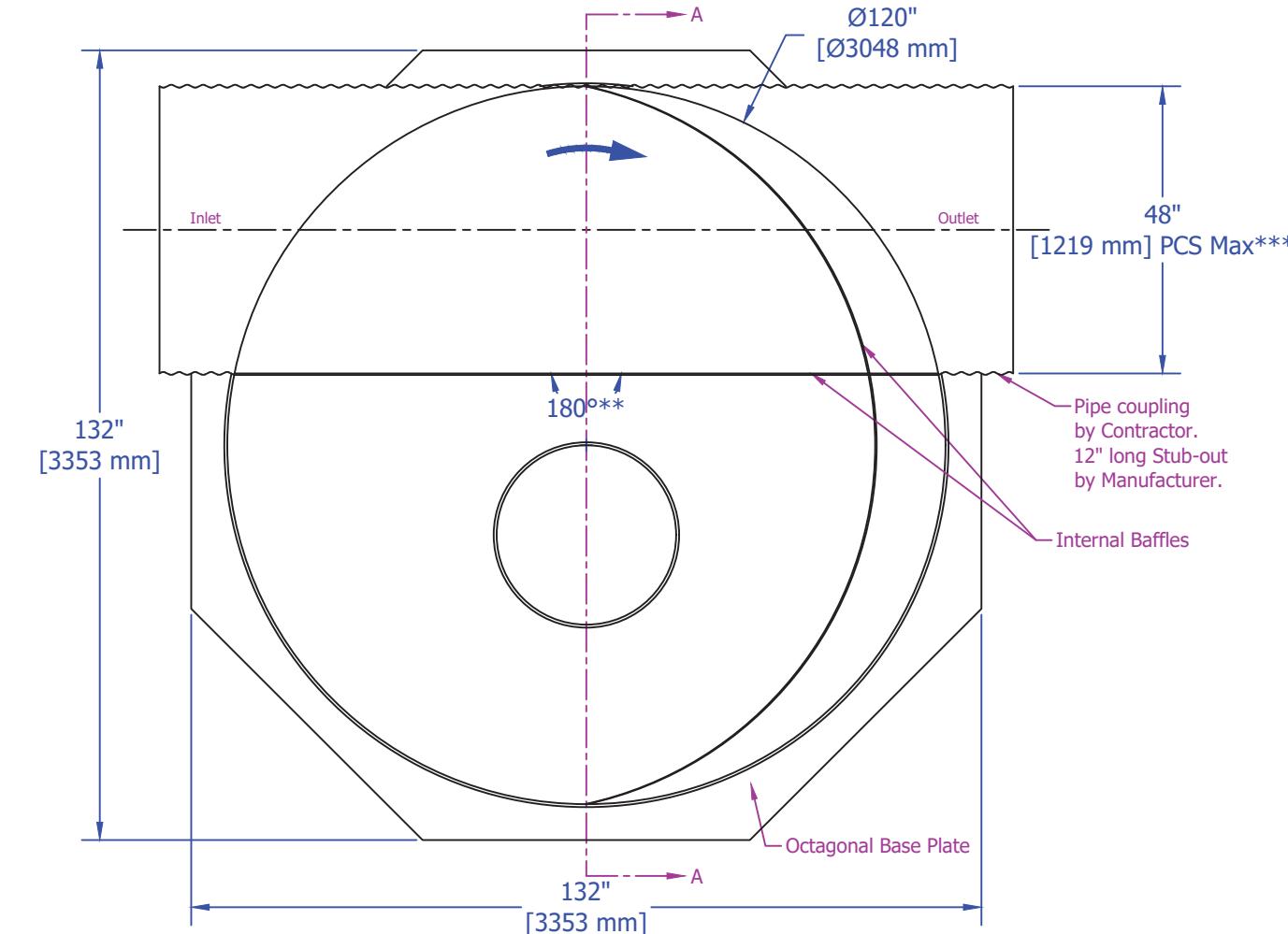
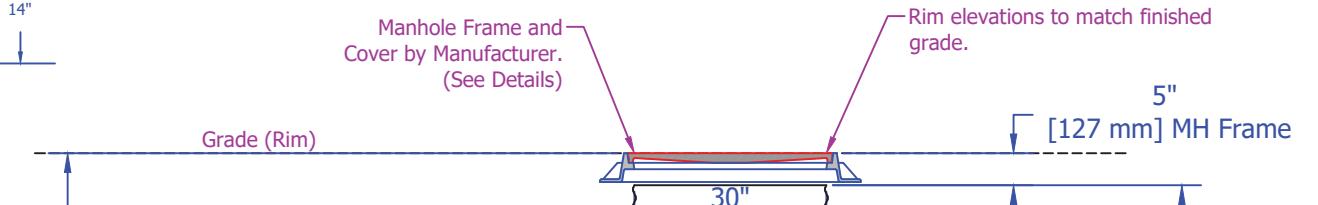
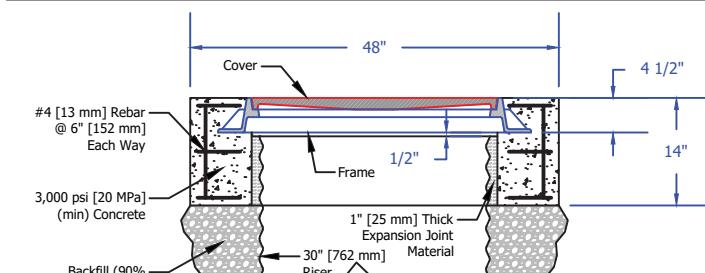
Unless other traffic barriers are present, bollards shall be placed around access riser(s) in non-traffic areas to prevent inadvertent loading by maintenance vehicles.



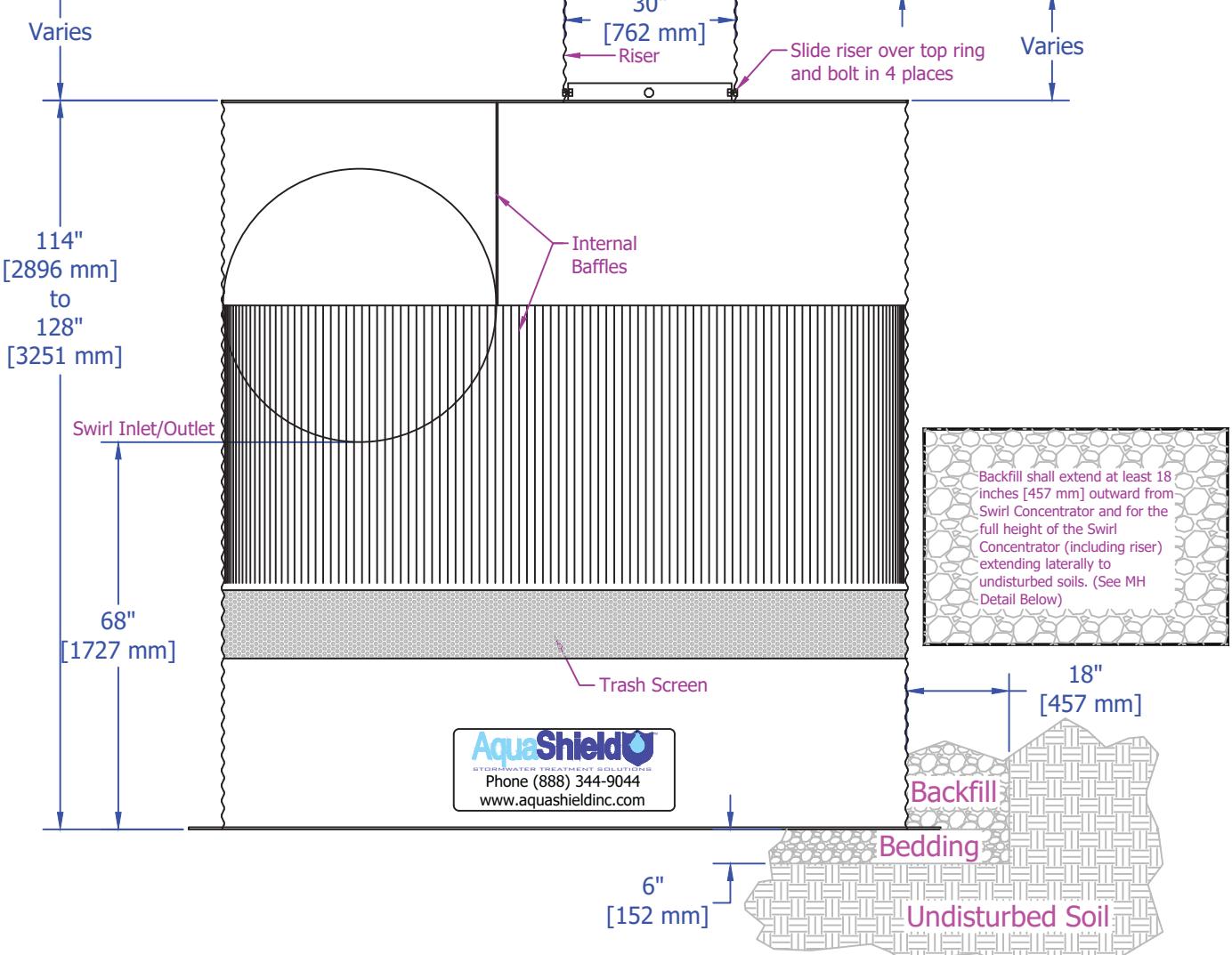
If traffic loading (HS-25) is required or anticipated, a 4-foot [1.22 m] diameter, 14-inch [356 mm] thick reinforced concrete pad must be placed over the Stormwater Treatment System Riser to support and level the manhole frame, as shown. The top of riser pipe must be wrapped with compressible expansion joint material to a minimum 1-inch [25 mm] thickness to allow transfer of wheel loads from manhole cover to concrete slab. Manhole cover shall bear on concrete slab and not on riser pipe. The concrete slab shall have a minimum strength of 3,000 psi [20 MPa] and be reinforced with #4 [13 mm] reinforcing steel as shown. Minimum cover over reinforcing steel shall be 1-inch [25 mm]. Top of manhole cover and concrete slab shall be level with finish grade.

**Note:** As an alternative, 42-inch OD, HS-20/25 rated precast concrete rings may be substituted. 14-inch thickness must be maintained.

- \* Please see accompanied Aqua-Swirl specification notes.
- \* See Site Plan for actual system orientation.
- \*\* Orientation may vary from 90°, 180°, or custom angles to meet site conditions.
- \*\*\*See Representative for larger pipe diameters available.



**Plan View**



**Section A-A**



# Aqua-Swirl™ Sizing Chart (English)

Aqua-Swirl™ Model	Swirl Chamber Diameter (ft.)	Maximum Stub-Out Pipe Outer Diameter (in.)		Water Quality Treatment Flow <sup>2</sup> (cfs)	Oil/Debris Storage Capacity (gal)	Sediment Storage Capacity (ft <sup>3</sup> )
		On/Offline	CFD <sup>1</sup>			
AS-2	2.50	8	12	1.1	37	10
AS-3	3.25	10	16	1.8	110	20
AS-4	4.25	12	18	3.2	190	32
AS-5	5.00	12	24	4.4	270	45
AS-6	6.00	14	30	6.3	390	65
AS-7	7.00	16	36	8.6	540	90
AS-8	8.00	18	42	11.2	710	115
AS-9	9.00	20	48	14.2	910	145
AS-10	10.0	22	54	17.5	1130	180
AS-12	12.0	24	48	25.2	1698	270
AS-XX	Custom	--	--	>26	--	--

\*Higher water quality treatment flow rates can be designed with multiple swirls.

- 1) The Aqua-Swirl™ Conveyance Flow Diversion (CFD) provides full treatment of the "first flush," while the peak design storm is diverted and channeled through the main conveyance pipe. Please refer to your local representative for more information.
- 2) Many regulatory agencies are establishing "water quality treatment flow rates" for their areas based on the initial movement of pollutants into the storm drainage system. The treatment flow rate of the Aqua-Swirl™ system is engineered to meet or exceed the local water quality treatment criteria. This "water quality treatment flow rate" typically represents approximately 90% to 95% of the total annual runoff volume.

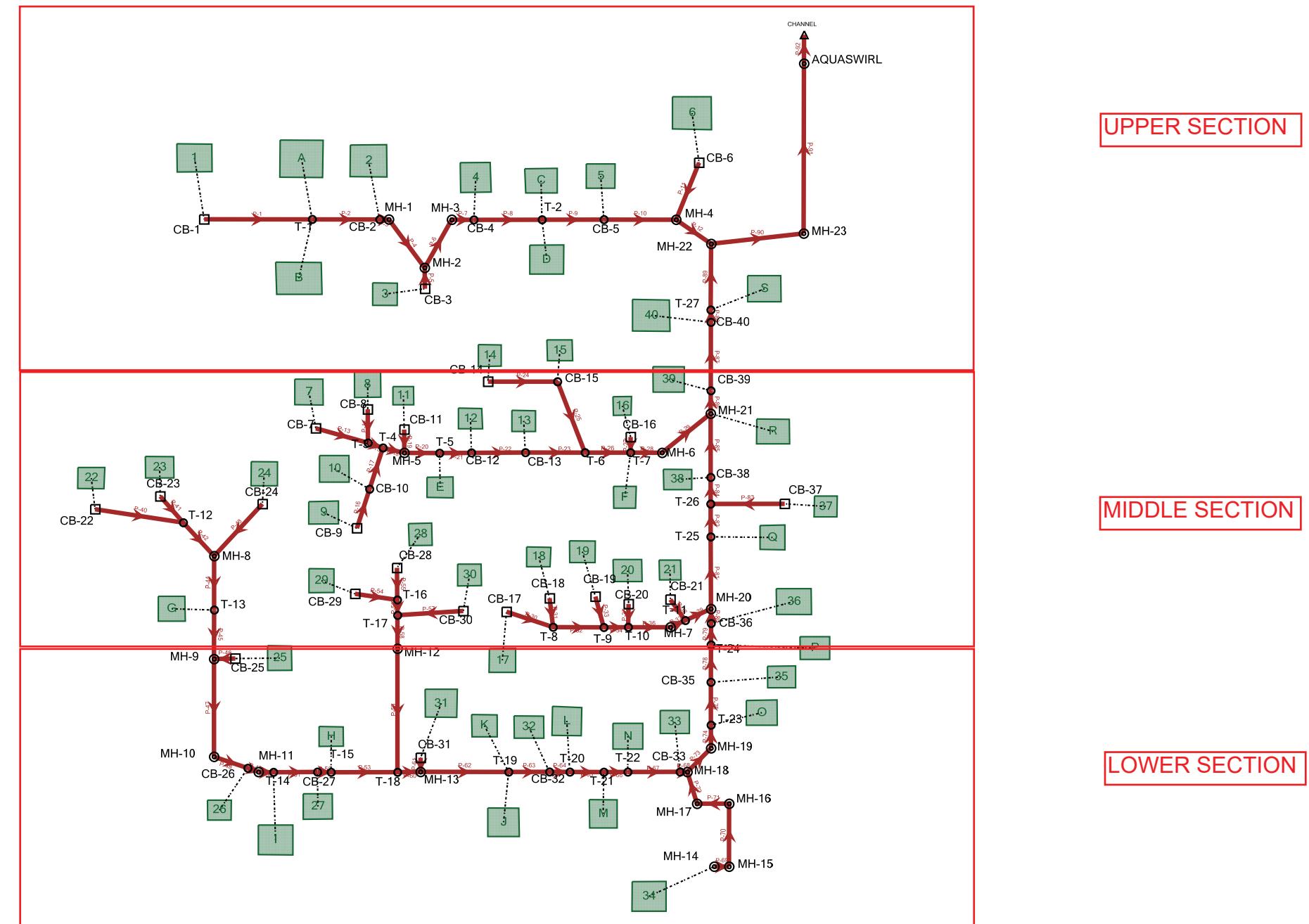
The design and orientation of the Aqua-Filter™ generally entails some degree of customization. For assistance in design and specific sizing using historical rainfall data, please refer to an AquaShield™ representative or visit our website at [www.AquaShieldInc.com](http://www.AquaShieldInc.com). CAD details and specifications are available upon request.

## **APPENDIX D**

### **StormCAD Results**

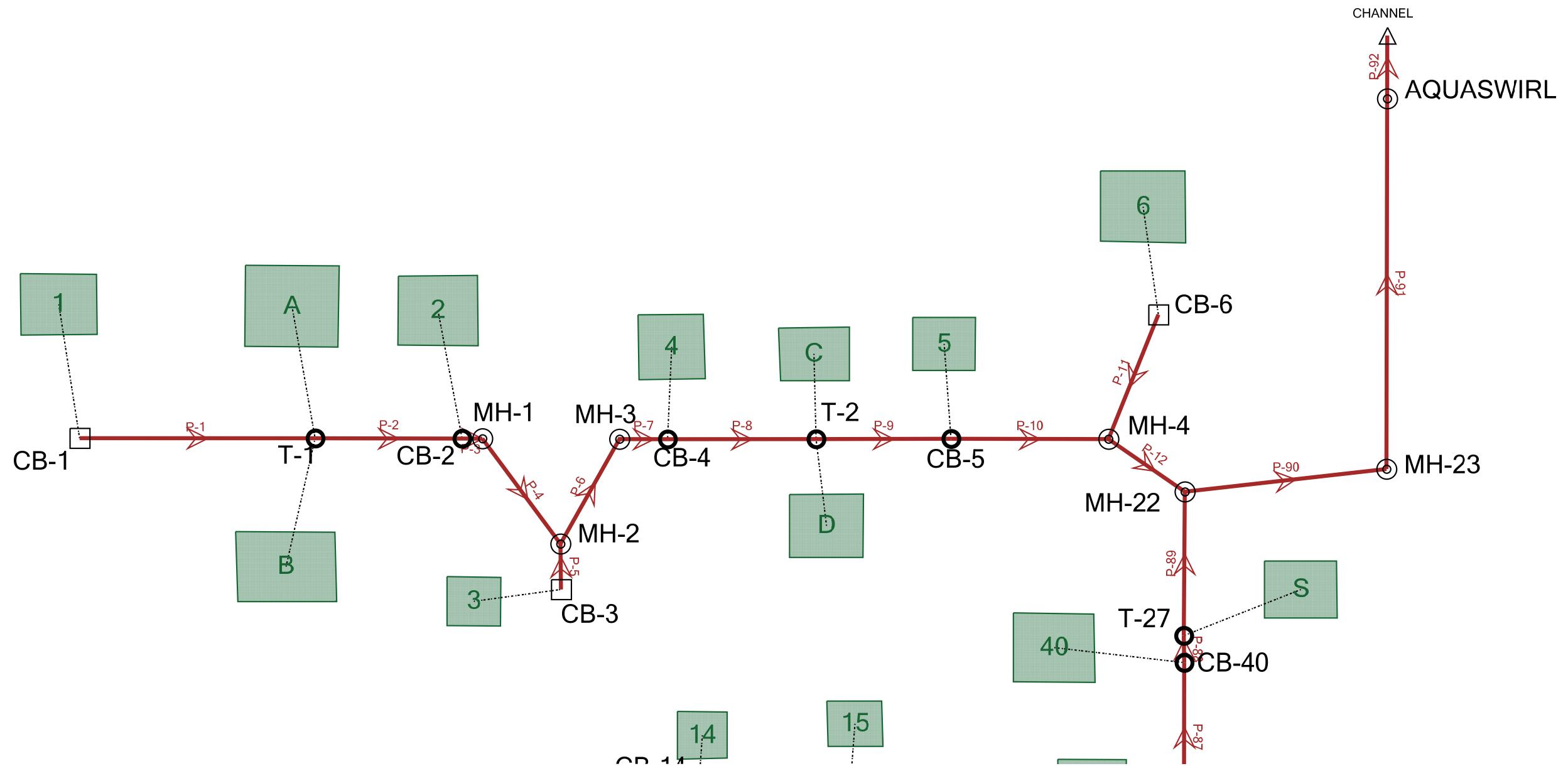
Scenario: 100-YR

**NOTE:** Some Catch Basins have been modeled as "transitions" due to StormCAD license limit of 25 inlets.



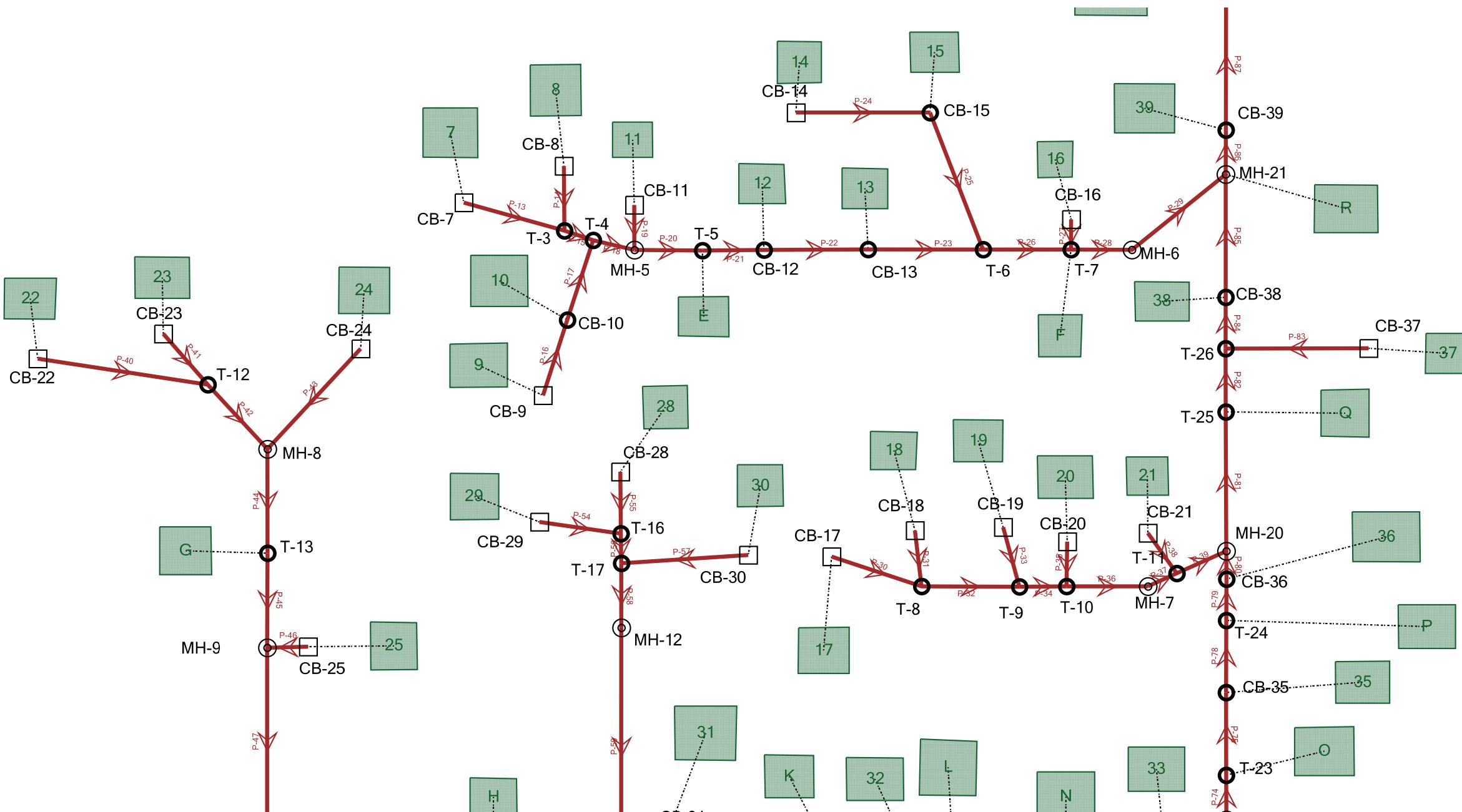
Scenario: 100-YR

UPPER SECTION



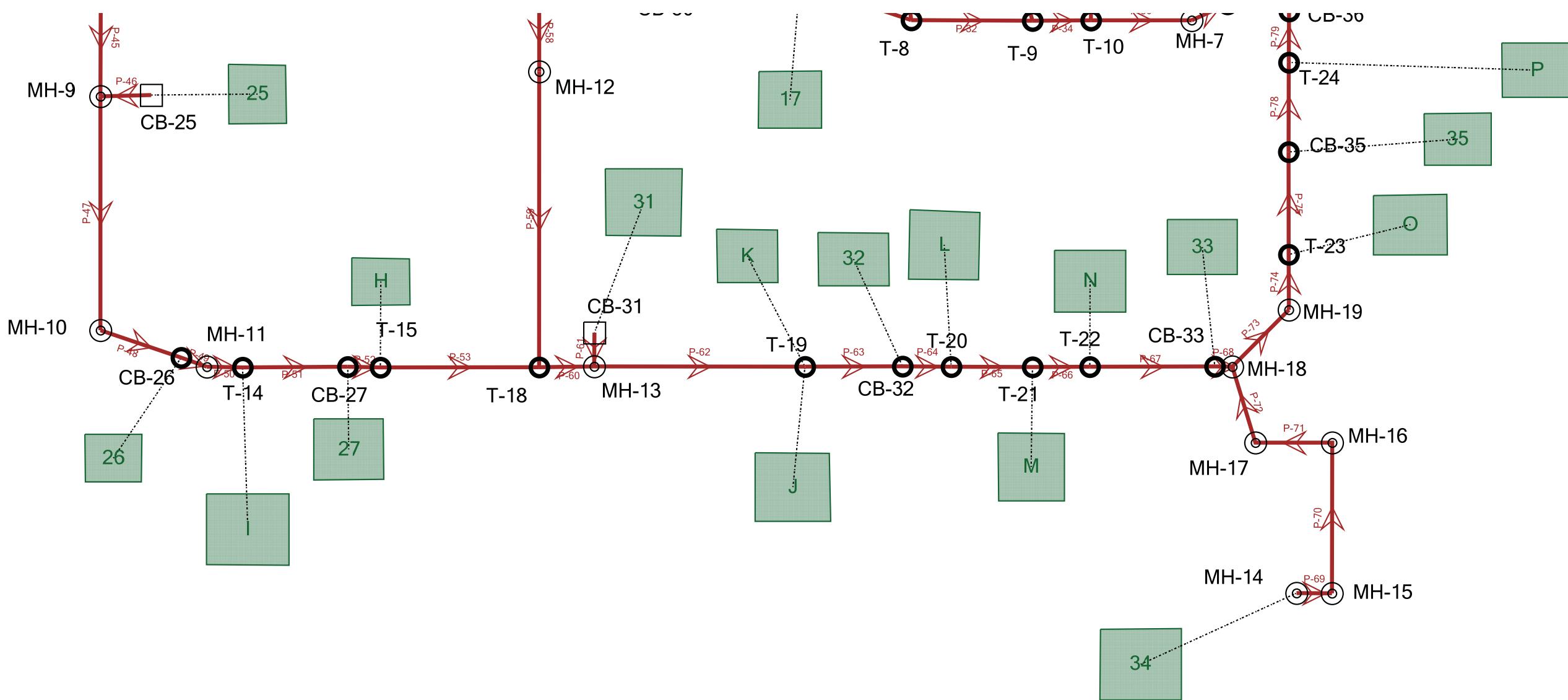
Scenario: 100-YR

MIDDLE SECTION



Scenario: 100-YR

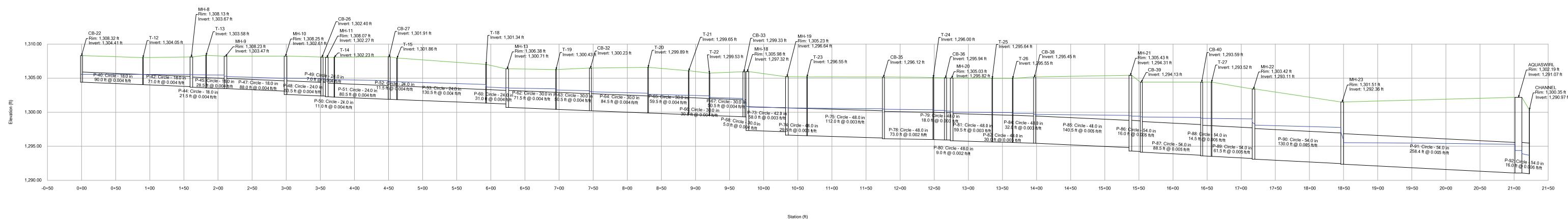
**LOWER SECTION**



Profile Report  
Engineering Profile - CB-22 to CHANNEL

Active Scenario: 100-YR

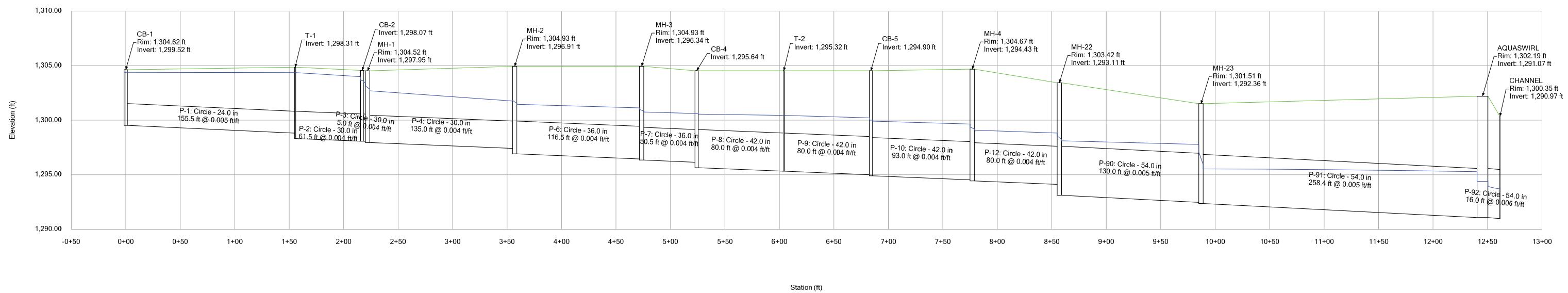
3/16/2020



Profile Report  
Engineering Profile - CB-1 to CHANNEL

Active Scenario: 100-YR

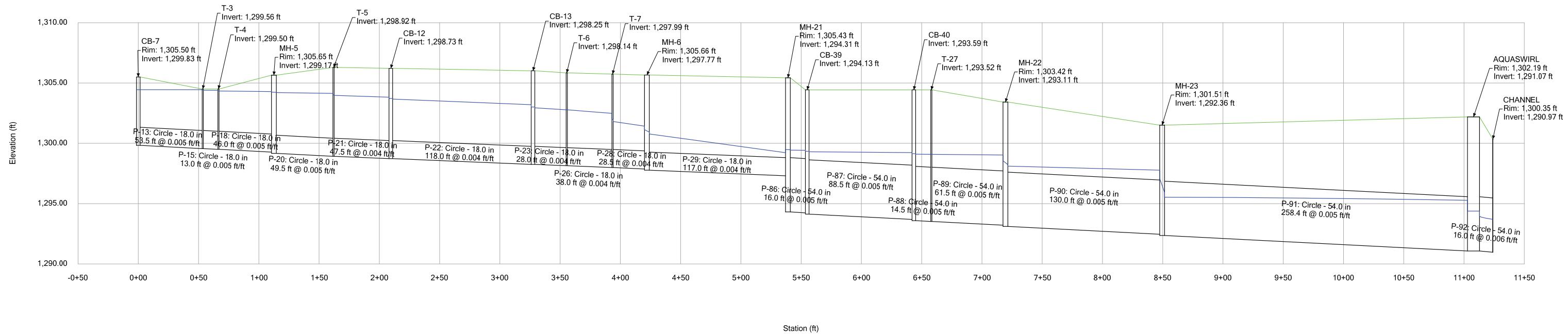
3/16/2020



Profile Report  
Engineering Profile - CB-7 to CHANNEL

Active Scenario: 100-YR

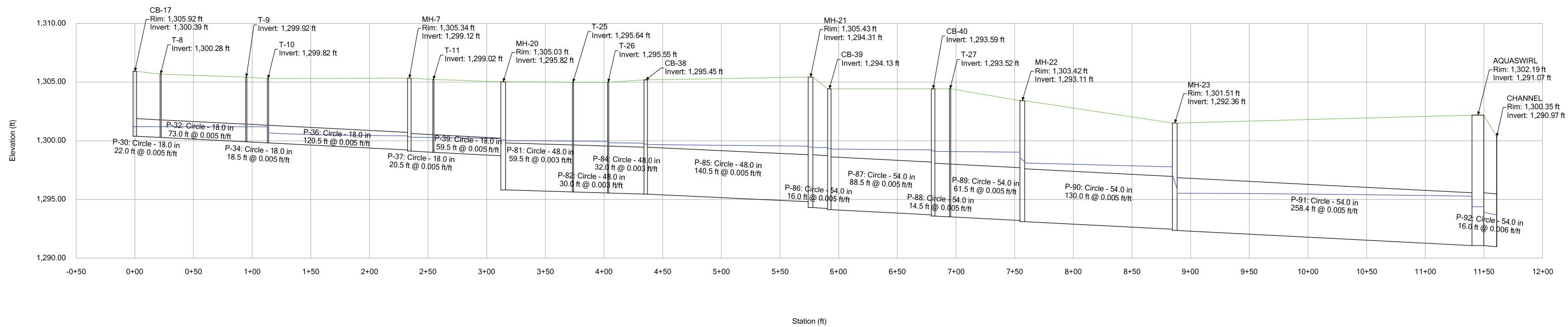
3/16/2020



Profile Report  
Engineering Profile - CB-17 to CHANNEL

Active Scenario: 100-YR

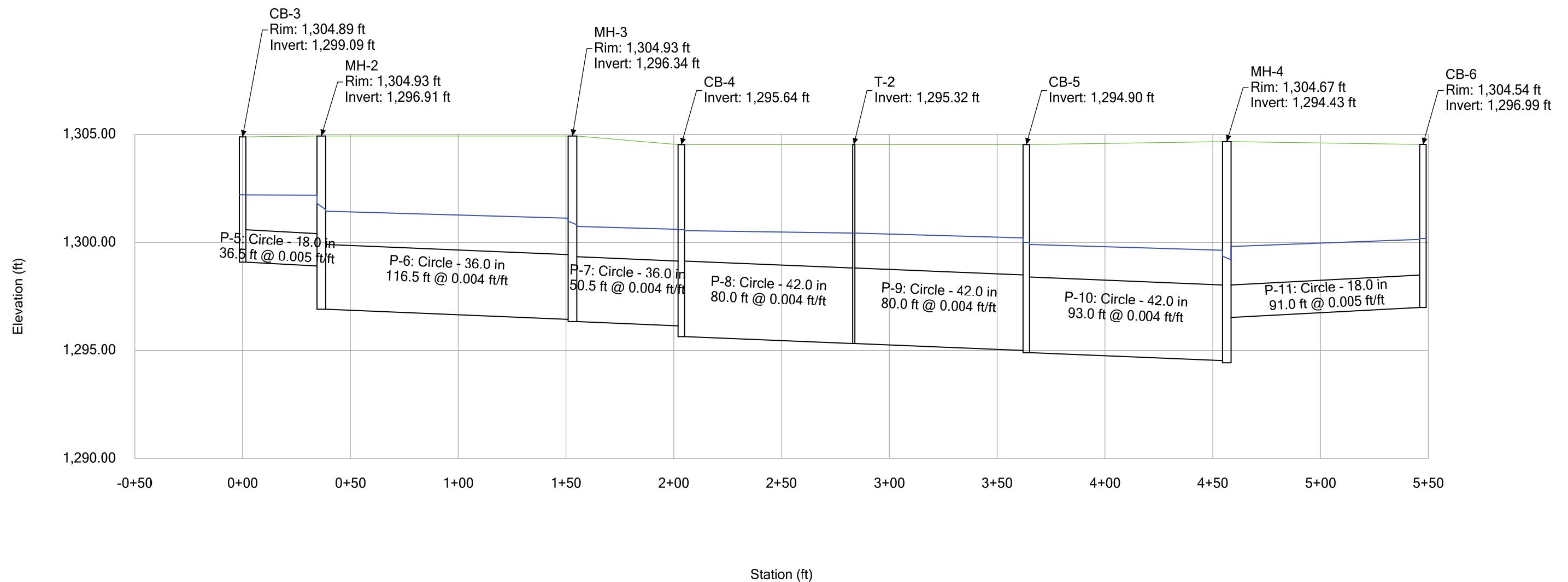
3/16/2020



Profile Report  
Engineering Profile - CB-3 to CB-6

Active Scenario: 100-YR

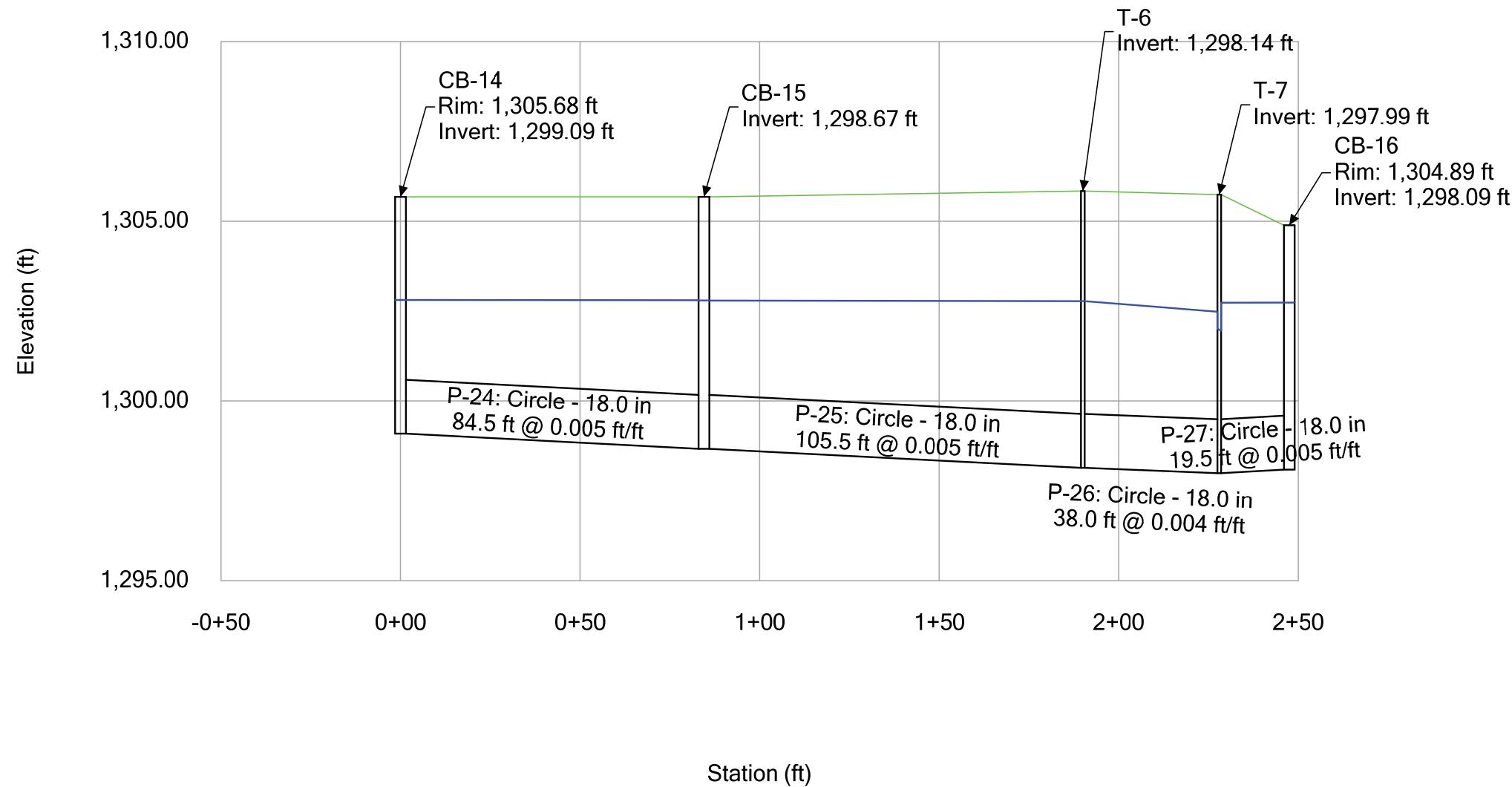
3/16/2020



Active Scenario: 100-YR

Profile Report  
Engineering Profile - CB-14 to CB-16

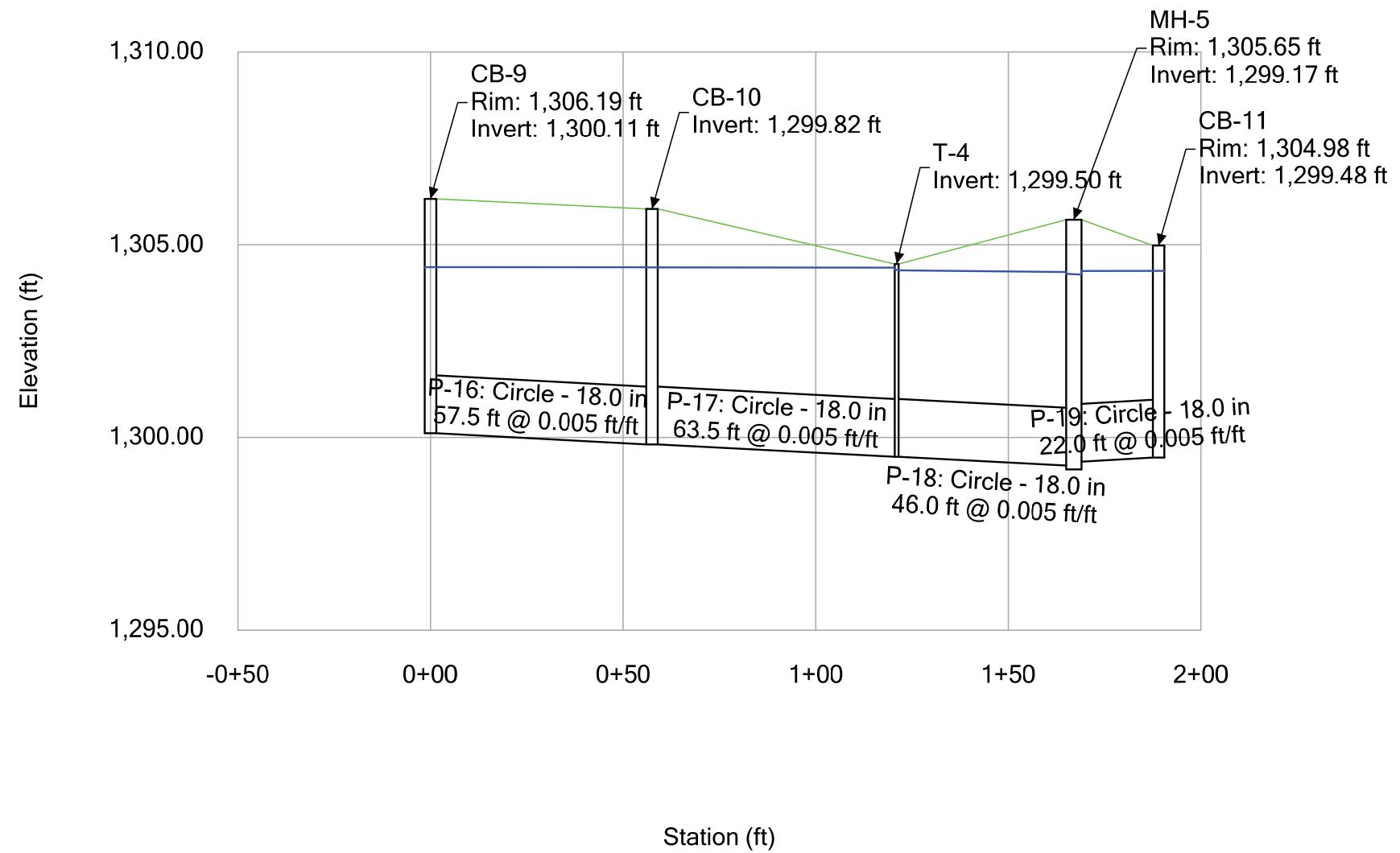
3/16/2020



Active Scenario: 100-YR

Profile Report  
Engineering Profile - CB-9 to CB-11

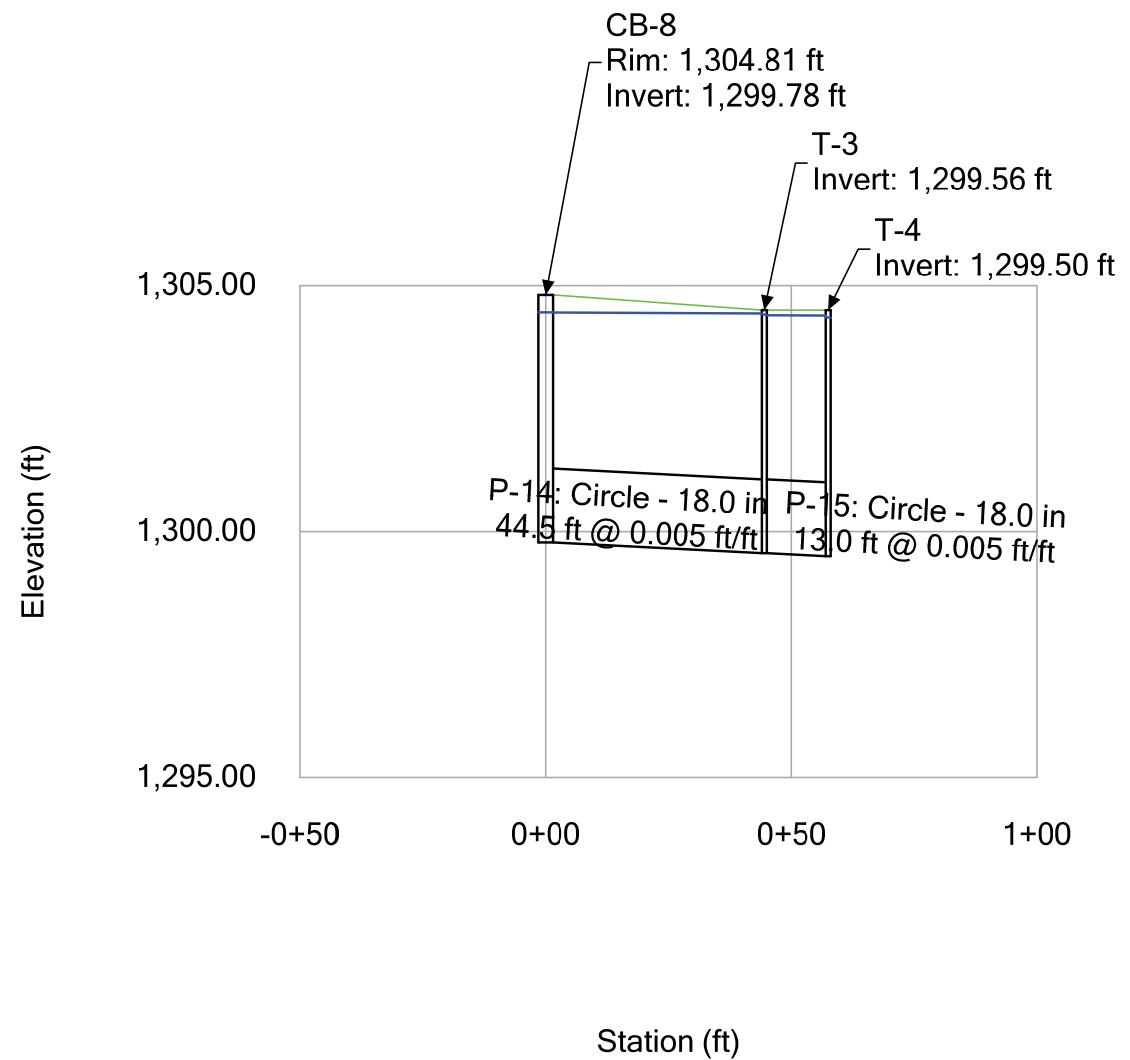
3/16/2020



Active Scenario: 100-YR

Profile Report  
Engineering Profile - CB-8 to T-4

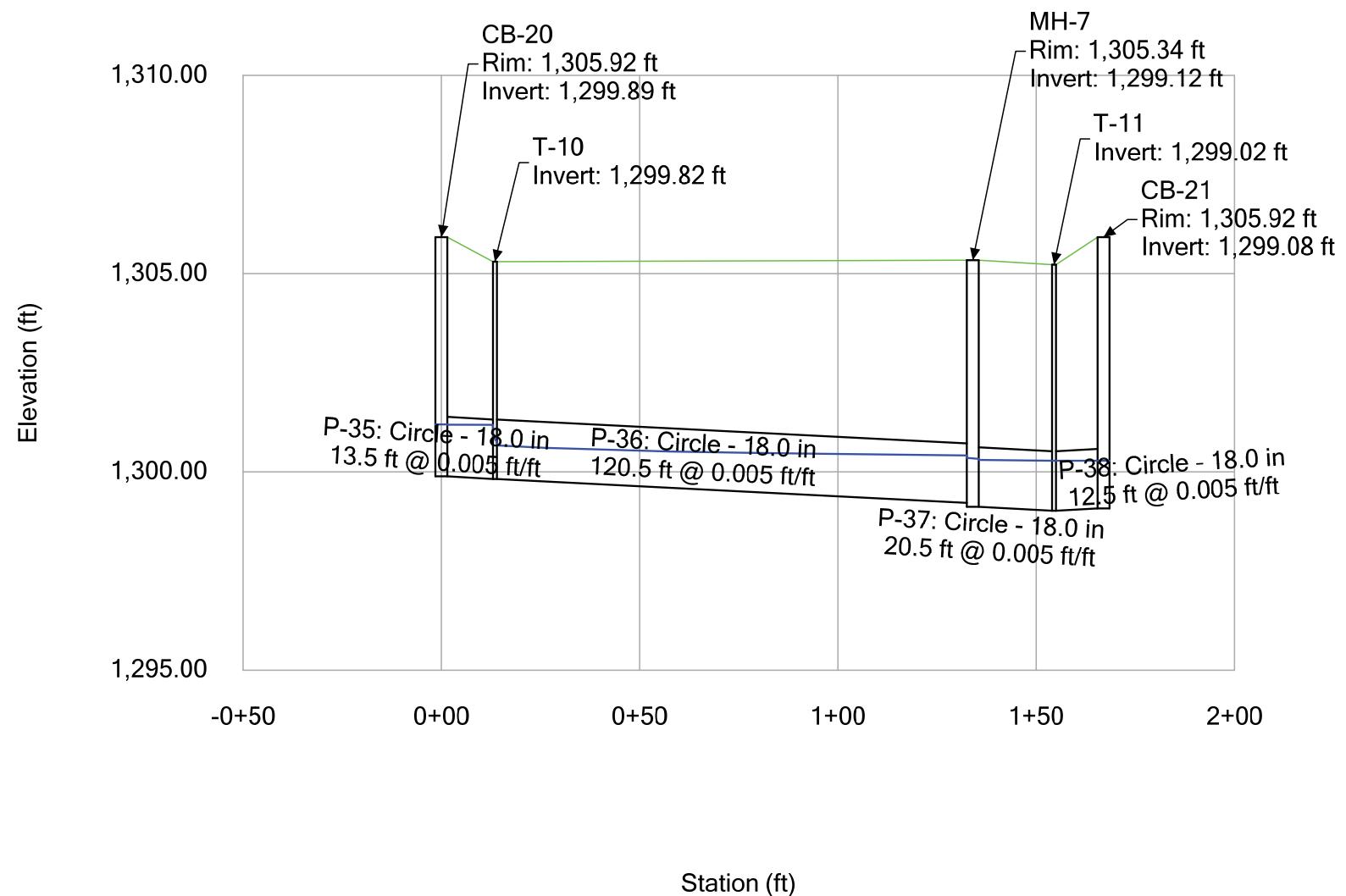
3/16/2020



Active Scenario: 100-YR

3/16/2020

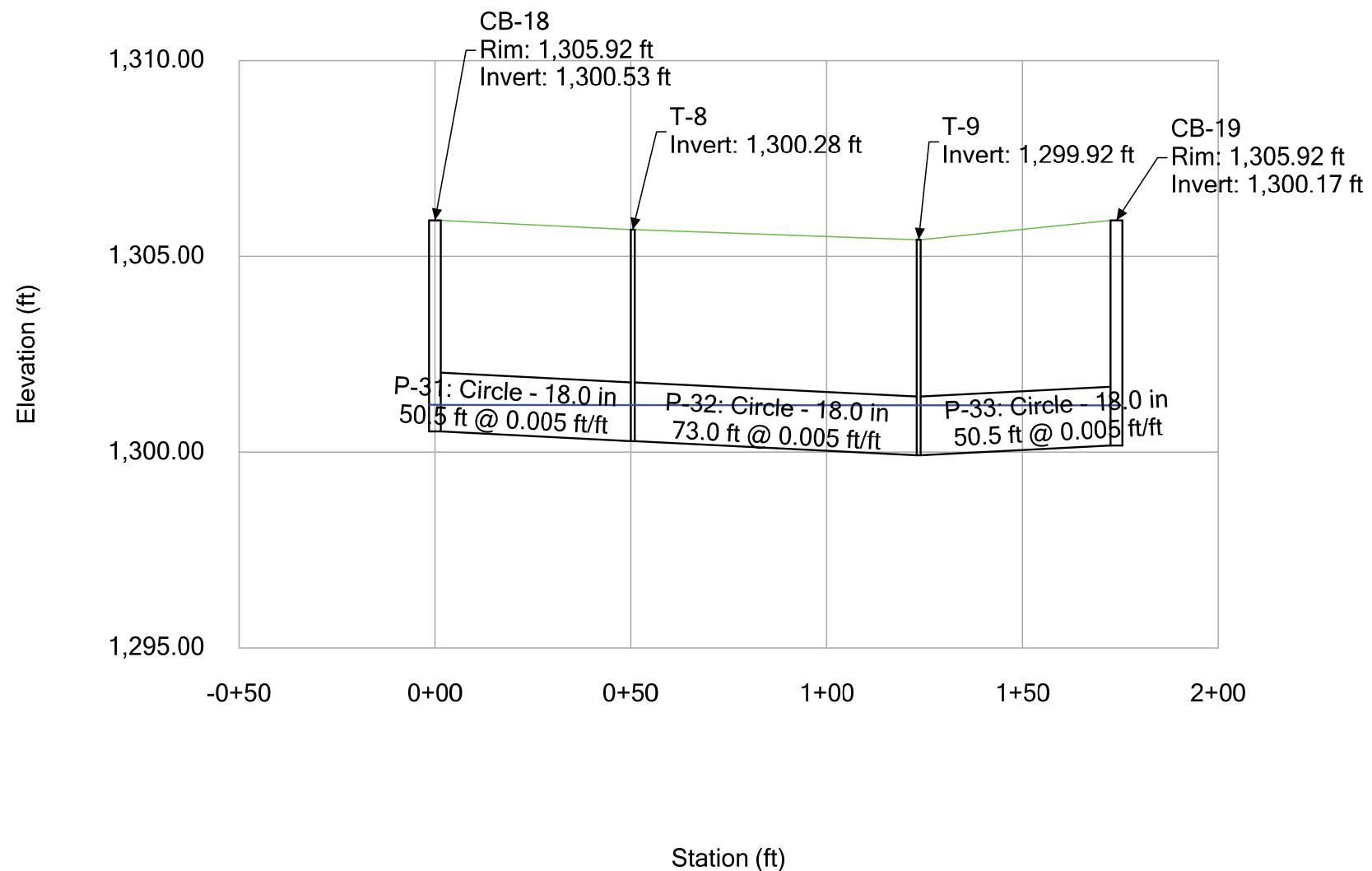
Profile Report  
Engineering Profile - CB-20 to CB-21



Active Scenario: 100-YR

3/16/2020

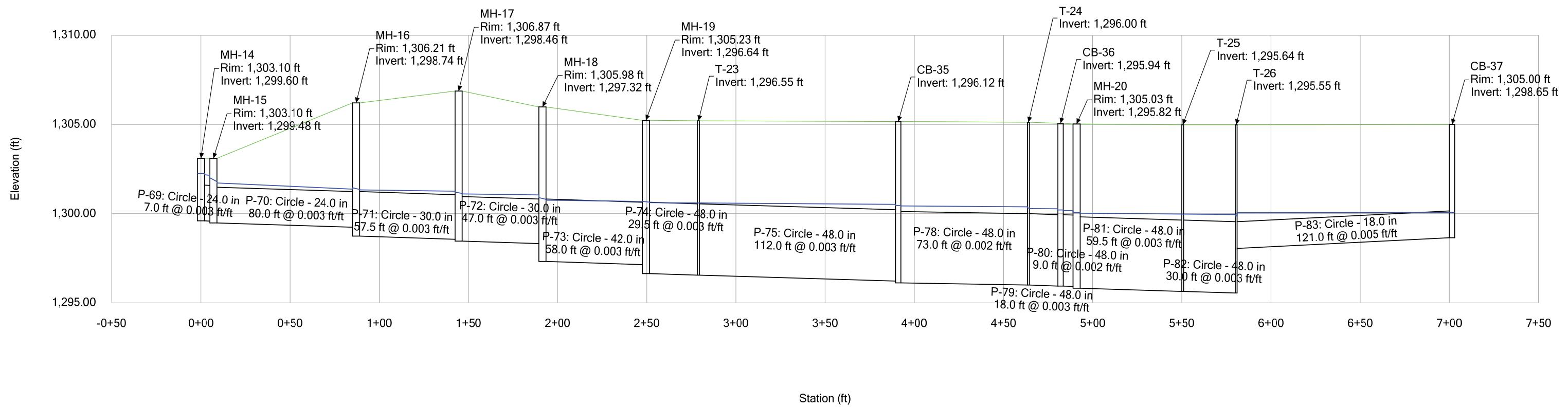
Profile Report  
Engineering Profile - CB-18 to CB-19



Profile Report  
Engineering Profile - MH-14 to CB-37

Active Scenario: 100-YR

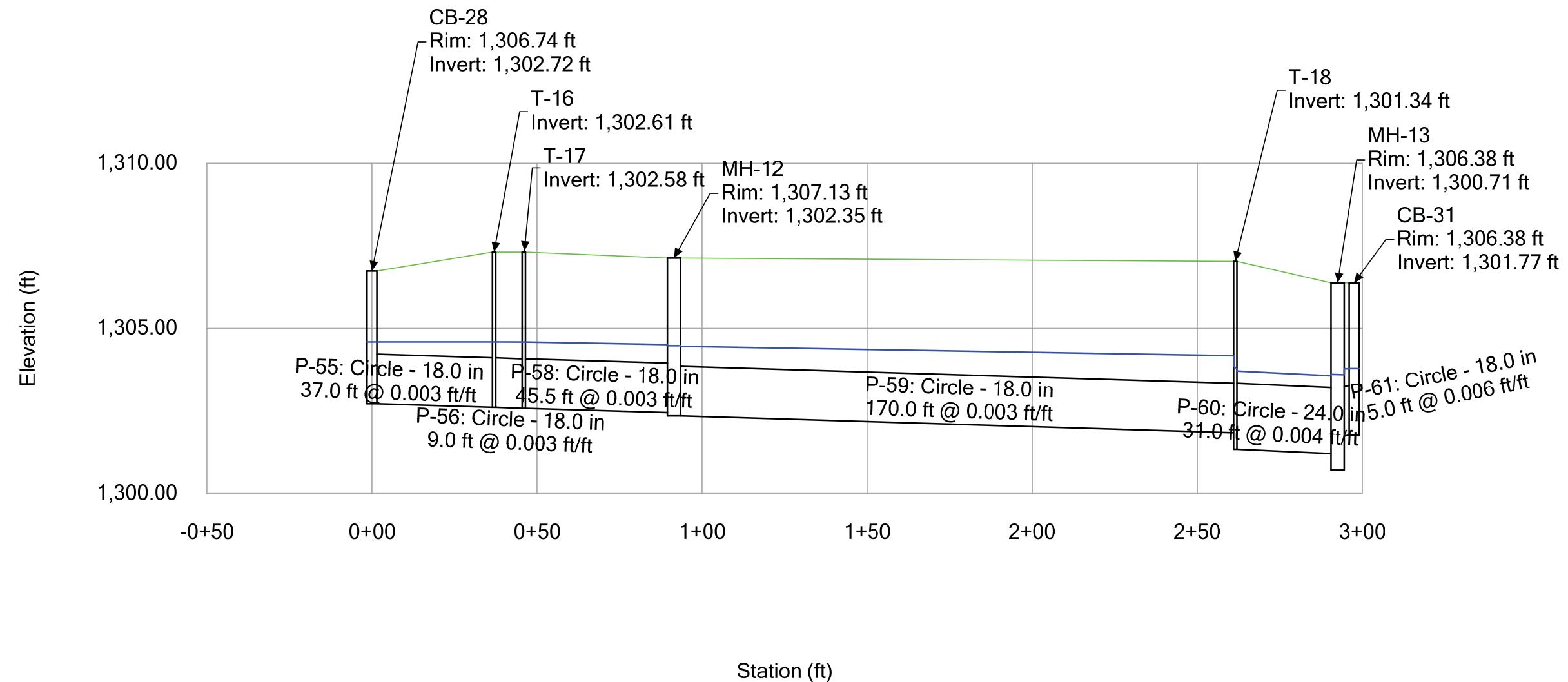
3/16/2020



Profile Report  
Engineering Profile - CB-28 to CB-31

Active Scenario: 100-YR

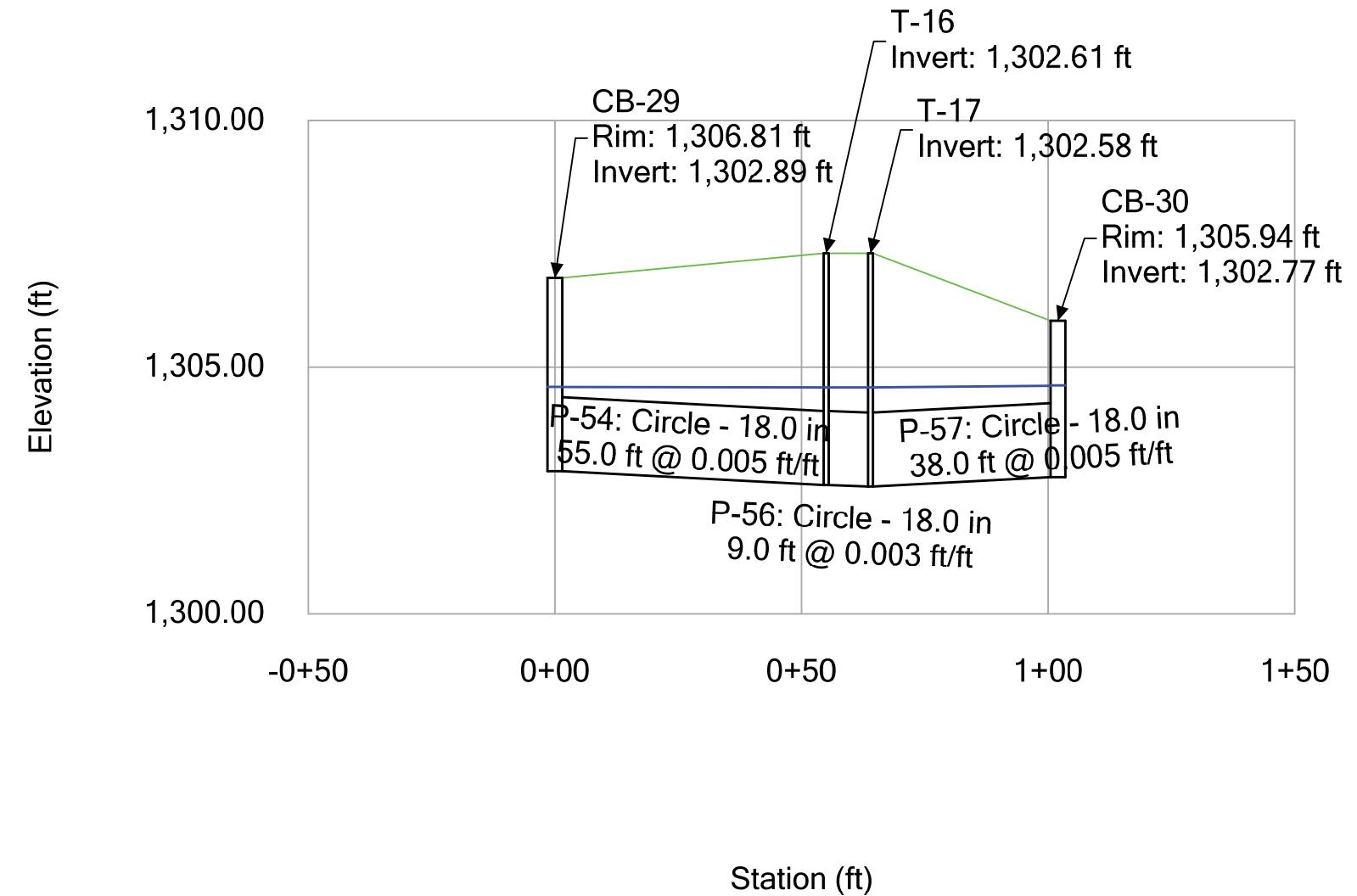
3/16/2020



Active Scenario: 100-YR

Profile Report  
Engineering Profile - CB-29 to CB-30

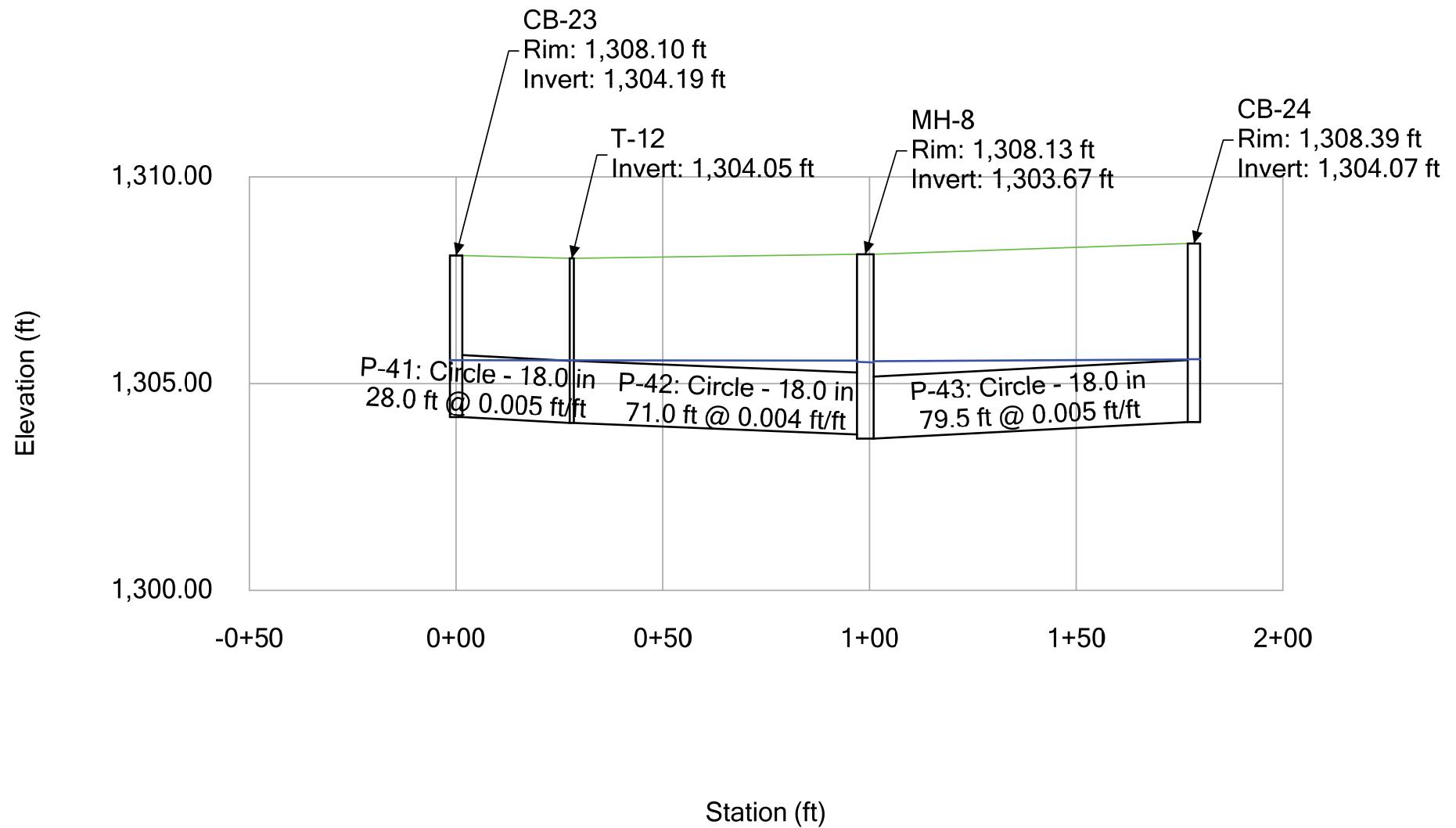
3/16/2020



Active Scenario: 100-YR

3/16/2020

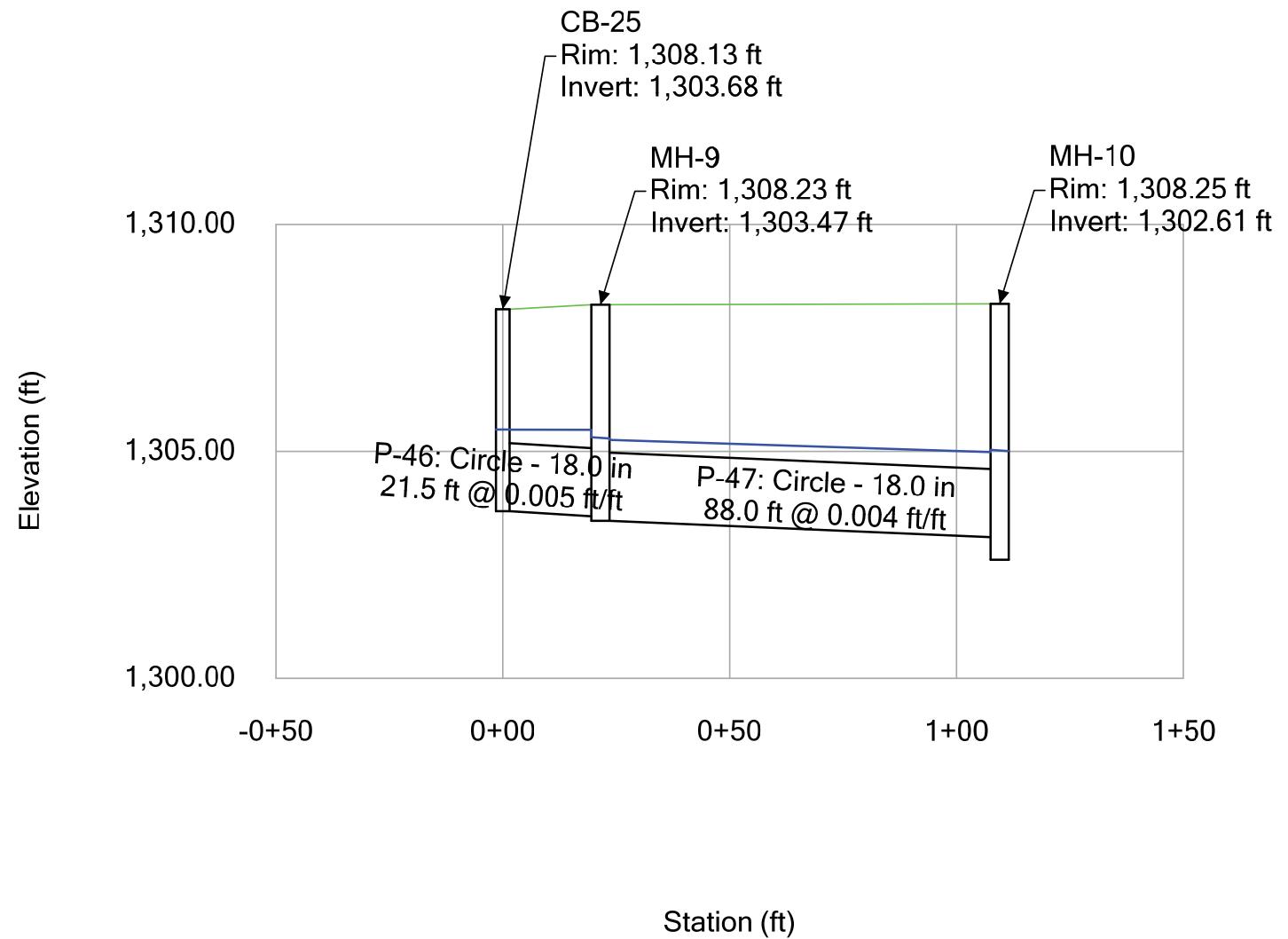
Profile Report  
Engineering Profile - CB-23 to CB-24



Active Scenario: 100-YR

3/16/2020

Profile Report  
Engineering Profile - CB-25 to MH-10



Active Scenario: 100-YR

## FlexTable: Catchment Table

3/17/2020

Label	Outflow Element	Area (User Defined) (ft <sup>2</sup> )	Runoff Coefficient (Rational)	Time of Concentration (min)	Flow (Total Out) (cfs)
1	CB-1	19,096	0.86	5.0	2.85
2	CB-2	19,096	0.86	5.0	2.85
3	CB-3	13,158	0.86	5.0	1.97
4	CB-4	28,344	0.86	5.0	4.24
5	CB-5	13,120	0.86	5.0	1.96
6	CB-6	42,390	0.86	5.0	6.34
7	CB-7	4,461	0.86	5.0	0.67
8	CB-8	14,257	0.86	5.0	2.13
9	CB-9	4,836	0.86	5.0	0.72
10	CB-10	3,129	0.86	5.0	0.47
11	CB-11	7,064	0.86	5.0	1.06
12	CB-12	6,534	0.86	5.0	0.98
13	CB-13	14,573	0.86	5.0	2.18
14	CB-14	5,184	0.86	5.0	0.77
15	CB-15	5,255	0.86	5.0	0.79
16	CB-16	8,793	0.86	5.0	1.31
17	CB-17	6,105	0.86	5.0	0.91
18	CB-18	5,332	0.86	5.0	0.80
19	CB-19	5,332	0.86	5.0	0.80
20	CB-20	17,058	0.86	5.0	2.55
21	CB-21	6,483	0.86	5.0	0.97
22	CB-22	3,105	0.86	5.0	0.46
23	CB-23	5,572	0.86	5.0	0.83
24	CB-24	16,271	0.86	5.0	2.43
25	CB-25	9,978	0.86	5.0	1.49
26	CB-26	21,398	0.86	5.0	3.20
27	CB-27	13,647	0.86	5.0	2.04
28	CB-28	3,428	0.86	5.0	0.51
29	CB-29	8,371	0.86	5.0	1.25
30	CB-30	20,985	0.86	5.0	3.14
31	CB-31	13,504	0.86	5.0	2.02
32	CB-32	7,897	0.86	5.0	1.18
33	CB-33	49,000	0.86	5.0	7.32

Active Scenario: 100-YR

## FlexTable: Catchment Table

3/17/2020

Label	Outflow Element	Area (User Defined) (ft <sup>2</sup> )	Runoff Coefficient (Rational)	Time of Concentration (min)	Flow (Total Out) (cfs)
34	MH-14	106,286	0.86	5.0	15.89
35	CB-35	9,293	0.86	5.0	1.39
36	CB-36	8,658	0.86	5.0	1.29
37	CB-37	5,974	0.86	5.0	0.89
38	CB-38	9,094	0.86	5.0	1.36
39	CB-39	24,446	0.86	5.0	3.65
40	CB-40	29,142	0.86	5.0	4.36
A	T-1	72,963	0.95	5.0	12.05
B	T-1	134,752	0.95	5.0	22.25
C	T-2	63,470	0.95	5.0	10.48
D	T-2	62,007	0.95	5.0	10.24
E	T-5	16,368	0.95	5.0	2.70
F	T-7	16,368	0.95	5.0	2.70
G	T-13	20,084	0.95	5.0	3.32
H	T-15	17,123	0.95	5.0	2.83
I	T-14	18,861	0.95	5.0	3.11
J	T-19	11,960	0.86	5.0	1.79
K	T-19	13,504	0.95	5.0	2.23
L	T-20	8,577	0.95	5.0	1.42
M	T-21	9,290	0.95	5.0	1.53
N	T-22	16,244	0.95	5.0	2.68
O	T-23	15,054	0.95	5.0	2.49
P	T-24	15,025	0.95	5.0	2.48
Q	T-25	4,908	0.95	5.0	0.81
R	MH-21	4,595	0.95	5.0	0.76
S	T-27	5,200	0.95	5.0	0.86

Active Scenario: 100-YR

## FlexTable: Catch Basin Table

3/16/2020

Label	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Flow (Captured) (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss Method
CB-1	1,304.62	1,304.62	1,299.52	2.85	1,304.39	1,304.39	HEC-22 Energy (Third Edition)
CB-3	1,304.89	1,304.89	1,299.09	1.97	1,302.21	1,302.21	HEC-22 Energy (Third Edition)
CB-6	1,304.54	1,304.54	1,296.99	6.34	1,300.19	1,300.19	HEC-22 Energy (Third Edition)
CB-7	1,305.50	1,305.50	1,299.83	0.67	1,304.45	1,304.45	HEC-22 Energy (Third Edition)
CB-8	1,304.81	1,304.81	1,299.78	2.13	1,304.46	1,304.46	HEC-22 Energy (Third Edition)
CB-9	1,306.19	1,306.19	1,300.11	0.72	1,304.42	1,304.42	HEC-22 Energy (Third Edition)
CB-11	1,304.98	1,304.98	1,299.48	1.06	1,304.33	1,304.33	HEC-22 Energy (Third Edition)
CB-14	1,305.68	1,305.68	1,299.09	0.77	1,302.81	1,302.81	HEC-22 Energy (Third Edition)
CB-16	1,304.89	1,304.89	1,298.09	1.31	1,302.74	1,302.74	HEC-22 Energy (Third Edition)
CB-17	1,305.92	1,305.92	1,300.39	0.91	1,301.21	1,301.21	HEC-22 Energy (Third Edition)
CB-18	1,305.92	1,305.92	1,300.53	0.80	1,301.21	1,301.21	HEC-22 Energy (Third Edition)
CB-19	1,305.92	1,305.92	1,300.17	0.80	1,301.20	1,301.20	HEC-22 Energy (Third Edition)
CB-20	1,305.92	1,305.92	1,299.89	2.55	1,301.20	1,301.20	HEC-22 Energy (Third Edition)
CB-21	1,305.92	1,305.92	1,299.08	0.97	1,300.29	1,300.29	HEC-22 Energy (Third Edition)
CB-22	1,308.32	1,308.32	1,304.41	0.46	1,305.58	1,305.58	HEC-22 Energy (Third Edition)
CB-23	1,308.10	1,308.10	1,304.19	0.83	1,305.58	1,305.58	HEC-22 Energy (Third Edition)
CB-24	1,308.39	1,308.39	1,304.07	2.43	1,305.61	1,305.61	HEC-22 Energy (Third Edition)
CB-25	1,308.13	1,308.13	1,303.68	1.49	1,305.50	1,305.50	HEC-22 Energy (Third Edition)
CB-28	1,306.74	1,306.74	1,302.72	0.51	1,304.61	1,304.61	HEC-22 Energy (Third Edition)
CB-29	1,306.81	1,306.81	1,302.89	1.25	1,304.62	1,304.62	HEC-22 Energy (Third Edition)
CB-30	1,305.94	1,305.94	1,302.77	3.14	1,304.65	1,304.65	HEC-22 Energy (Third Edition)
CB-31	1,306.38	1,306.38	1,301.77	2.02	1,303.80	1,303.80	HEC-22 Energy (Third Edition)
CB-37	1,305.00	1,305.00	1,298.65	0.89	1,300.07	1,300.07	HEC-22 Energy (Third Edition)

Active Scenario: 100-YR

## FlexTable: Transition Table

3/16/2020

Label	Elevation (Ground) (ft)	Elevation (Top) (ft)	Elevation (Invert) (ft)	Transition Length (ft)	Flow (Total Out) (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
CB-2	1,304.56	1,304.56	1,298.07	3.0	34.23	1,303.63	1,303.63
CB-4	1,304.53	1,304.53	1,295.64	3.0	37.55	1,300.60	1,300.60
CB-5	1,304.53	1,304.53	1,294.90	3.0	54.06	1,300.01	1,300.01
CB-10	1,305.93	1,305.93	1,299.82	3.0	1.06	1,304.42	1,304.42
CB-12	1,306.22	1,306.22	1,298.73	3.0	6.60	1,303.72	1,303.72
CB-13	1,306.01	1,306.01	1,298.25	3.0	8.10	1,303.01	1,303.01
CB-15	1,305.68	1,305.68	1,298.67	3.0	1.32	1,302.80	1,302.80
CB-26	1,308.11	1,308.11	1,302.40	3.0	7.72	1,304.92	1,304.92
CB-27	1,308.15	1,308.15	1,301.91	3.0	10.86	1,304.57	1,304.57
CB-32	1,306.49	1,306.49	1,300.23	3.0	19.81	1,303.06	1,303.06
CB-33	1,305.96	1,305.96	1,299.33	3.0	27.28	1,301.67	1,301.67
CB-35	1,305.16	1,305.16	1,296.12	3.0	38.33	1,300.47	1,300.47
CB-36	1,305.07	1,305.07	1,295.94	3.0	40.11	1,300.21	1,300.21
CB-38	1,305.19	1,305.19	1,295.45	3.0	44.76	1,299.72	1,299.72
CB-39	1,304.43	1,304.43	1,294.13	3.0	55.82	1,299.34	1,299.34
CB-40	1,304.43	1,304.43	1,293.59	3.0	57.69	1,299.14	1,299.14
T-1	1,304.85	1,304.85	1,298.31	1.0	32.07	1,304.36	1,304.36
T-2	1,304.53	1,304.53	1,295.32	1.0	53.29	1,300.44	1,300.44
T-3	1,304.50	1,304.50	1,299.56	1.0	2.48	1,304.42	1,304.41
T-4	1,304.50	1,304.50	1,299.50	1.0	3.20	1,304.36	1,304.35
T-5	1,306.29	1,306.29	1,298.92	1.0	5.92	1,304.02	1,304.02
T-6	1,305.84	1,305.84	1,298.14	1.0	9.22	1,302.78	1,302.78
T-7	1,305.74	1,305.74	1,297.99	1.0	12.14	1,302.01	1,301.96
T-8	1,305.68	1,305.68	1,300.28	1.0	1.63	1,301.20	1,301.20
T-9	1,305.42	1,305.42	1,299.92	1.0	2.27	1,301.19	1,301.19
T-10	1,305.30	1,305.30	1,299.82	1.0	4.53	1,300.91	1,300.75
T-11	1,305.23	1,305.23	1,299.02	1.0	5.20	1,300.29	1,300.29
T-12	1,308.03	1,308.03	1,304.05	1.0	0.98	1,305.58	1,305.58
T-13	1,308.37	1,308.37	1,303.58	1.0	4.87	1,305.50	1,305.50
T-14	1,308.09	1,308.09	1,302.23	1.0	9.72	1,304.81	1,304.81
T-15	1,307.96	1,307.96	1,301.86	1.0	12.65	1,304.50	1,304.50
T-16	1,307.31	1,307.31	1,302.61	1.0	1.58	1,304.61	1,304.61
T-17	1,307.31	1,307.31	1,302.58	1.0	4.36	1,304.61	1,304.61

Active Scenario: 100-YR

## FlexTable: Transition Table

3/16/2020

Label	Elevation (Ground) (ft)	Elevation (Top) (ft)	Elevation (Invert) (ft)	Transition Length (ft)	Flow (Total Out) (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
T-18	1,307.03	1,307.03	1,301.34	1.0	15.45	1,303.87	1,303.80
T-19	1,306.28	1,306.28	1,300.43	1.0	19.17	1,303.33	1,303.33
T-20	1,306.60	1,306.60	1,299.89	1.0	20.52	1,302.70	1,302.70
T-21	1,306.10	1,306.10	1,299.65	1.0	21.35	1,302.50	1,302.50
T-22	1,305.75	1,305.75	1,299.53	1.0	22.93	1,302.25	1,302.25
T-23	1,305.20	1,305.20	1,296.55	1.0	38.05	1,300.61	1,300.61
T-24	1,305.12	1,305.12	1,296.00	1.0	39.44	1,300.32	1,300.32
T-25	1,304.98	1,304.98	1,295.64	1.0	43.76	1,299.98	1,299.98
T-26	1,304.98	1,304.98	1,295.55	1.0	44.13	1,299.87	1,299.87
T-27	1,304.43	1,304.43	1,293.52	1.0	58.08	1,299.09	1,299.09

Active Scenario: 100-YR

## FlexTable: Manhole Table

3/16/2020

Label	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Flow (Total Out) (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss Method
AQUASWIRL	1,302.19	1,302.19	1,291.07	97.23	1,294.39	1,294.39	HEC-22 Energy (Third Edition)
MH-1	1,304.52	1,304.52	1,297.95	34.21	1,303.14	1,302.84	HEC-22 Energy (Third Edition)
MH-2	1,304.93	1,304.93	1,296.91	35.24	1,301.82	1,301.53	HEC-22 Energy (Third Edition)
MH-3	1,304.93	1,304.93	1,296.34	34.46	1,300.99	1,300.82	HEC-22 Energy (Third Edition)
MH-4	1,304.67	1,304.67	1,294.43	58.04	1,299.37	1,299.20	HEC-22 Energy (Third Edition)
MH-5	1,305.65	1,305.65	1,299.17	3.95	1,304.25	1,304.23	HEC-22 Energy (Third Edition)
MH-6	1,305.66	1,305.66	1,297.77	12.11	1,301.14	1,300.93	HEC-22 Energy (Third Edition)
MH-7	1,305.34	1,305.34	1,299.12	4.39	1,300.36	1,300.34	HEC-22 Energy (Third Edition)
MH-8	1,308.13	1,308.13	1,303.67	2.60	1,305.54	1,305.53	HEC-22 Energy (Third Edition)
MH-9	1,308.23	1,308.23	1,303.47	5.83	1,305.33	1,305.30	HEC-22 Energy (Third Edition)
MH-10	1,308.25	1,308.25	1,302.61	5.73	1,305.05	1,305.02	HEC-22 Energy (Third Edition)
MH-11	1,308.07	1,308.07	1,302.27	7.70	1,304.85	1,304.84	HEC-22 Energy (Third Edition)
MH-12	1,307.13	1,307.13	1,302.35	4.29	1,304.50	1,304.50	HEC-22 Energy (Third Edition)
MH-13	1,306.38	1,306.38	1,300.71	16.68	1,303.63	1,303.61	HEC-22 Energy (Third Edition)
MH-14	1,303.10	1,303.10	1,299.60	15.89	1,302.42	1,302.42	HEC-22 Energy (Third Edition)
MH-15	1,303.10	1,303.10	1,299.48	15.87	1,302.15	1,301.90	HEC-22 Energy (Third Edition)
MH-16	1,306.21	1,306.21	1,298.74	15.67	1,301.50	1,301.40	HEC-22 Energy (Third Edition)
MH-17	1,306.87	1,306.87	1,298.46	15.44	1,301.23	1,301.15	HEC-22 Energy (Third Edition)
MH-18	1,305.98	1,305.98	1,297.32	36.90	1,300.91	1,300.81	HEC-22 Energy (Third Edition)
MH-19	1,305.23	1,305.23	1,296.64	36.69	1,300.70	1,300.65	HEC-22 Energy (Third Edition)
MH-20	1,305.03	1,305.03	1,295.82	43.58	1,300.08	1,300.07	HEC-22 Energy (Third Edition)
MH-21	1,305.43	1,305.43	1,294.31	53.85	1,299.49	1,299.47	HEC-22 Energy (Third Edition)
MH-22	1,303.42	1,303.42	1,293.11	99.52	1,298.55	1,298.23	HEC-22 Energy (Third Edition)
MH-23	1,301.51	1,301.51	1,292.36	98.67	1,297.09	1,295.92	HEC-22 Energy (Third Edition)

Active Scenario: 100-YR

## FlexTable: Conduit Table

3/16/2020

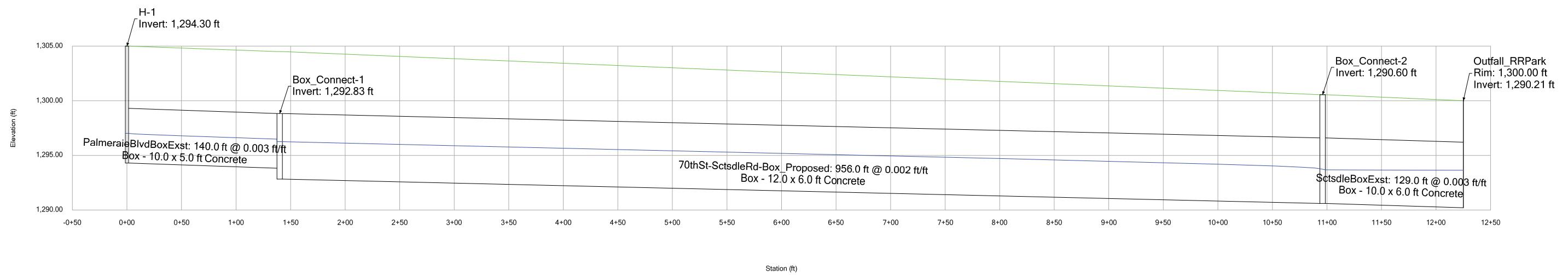
Label	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Section Type	Diameter (in)	Material	Manning's n	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Flow (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Velocity (ft/s)
P-1	CB-1	1,299.52	T-1	1,298.81	Circle	24.0	Concrete	0.013	155.5	0.005	1,304.62	1,304.85	2.85	1,304.38	1,304.36	0.91
P-2	T-1	1,298.31	CB-2	1,298.07	Circle	30.0	Concrete	0.013	61.5	0.004	1,304.85	1,304.56	32.07	1,304.36	1,303.98	6.53
P-3	CB-2	1,298.07	MH-1	1,298.05	Circle	30.0	Concrete	0.013	5.0	0.004	1,304.56	1,304.52	34.23	1,303.47	1,303.44	6.97
P-4	MH-1	1,297.95	MH-2	1,297.41	Circle	30.0	Concrete	0.013	135.0	0.004	1,304.52	1,304.93	34.21	1,302.69	1,301.75	6.97
P-5	CB-3	1,299.09	MH-2	1,298.91	Circle	18.0	Concrete	0.013	36.5	0.005	1,304.89	1,304.93	1.97	1,302.20	1,302.19	1.11
P-6	MH-2	1,296.91	MH-3	1,296.44	Circle	36.0	Concrete	0.013	116.5	0.004	1,304.93	1,304.93	35.24	1,301.45	1,301.13	4.99
P-7	MH-3	1,296.34	CB-4	1,296.14	Circle	36.0	Concrete	0.013	50.5	0.004	1,304.93	1,304.53	34.46	1,300.75	1,300.61	4.87
P-8	CB-4	1,295.64	T-2	1,295.32	Circle	42.0	Concrete	0.013	80.0	0.004	1,304.53	1,304.53	37.55	1,300.55	1,300.44	3.90
P-9	T-2	1,295.32	CB-5	1,295.00	Circle	42.0	Concrete	0.013	80.0	0.004	1,304.53	1,304.53	53.29	1,300.44	1,300.21	5.54
P-10	CB-5	1,294.90	MH-4	1,294.53	Circle	42.0	Concrete	0.013	93.0	0.004	1,304.53	1,304.67	54.06	1,299.91	1,299.64	5.62
P-11	CB-6	1,296.99	MH-4	1,296.53	Circle	18.0	Concrete	0.013	91.0	0.005	1,304.54	1,304.67	6.34	1,300.15	1,299.82	3.59
P-12	MH-4	1,294.43	MH-22	1,294.11	Circle	42.0	Concrete	0.013	80.0	0.004	1,304.67	1,303.42	58.04	1,299.09	1,298.82	6.03
P-13	CB-7	1,299.83	T-3	1,299.56	Circle	18.0	Concrete	0.013	53.5	0.005	1,305.50	1,304.50	0.67	1,304.45	1,304.45	0.38
P-14	CB-8	1,299.78	T-3	1,299.56	Circle	18.0	Concrete	0.013	44.5	0.005	1,304.81	1,304.50	2.13	1,304.46	1,304.44	1.21
P-15	T-3	1,299.56	T-4	1,299.50	Circle	18.0	Concrete	0.013	13.0	0.005	1,304.50	1,304.50	2.48	1,304.40	1,304.39	1.40
P-16	CB-9	1,300.11	CB-10	1,299.82	Circle	18.0	Concrete	0.013	57.5	0.005	1,306.19	1,305.93	0.72	1,304.42	1,304.42	0.41
P-17	CB-10	1,299.82	T-4	1,299.50	Circle	18.0	Concrete	0.013	63.5	0.005	1,305.93	1,304.50	1.06	1,304.42	1,304.41	0.60
P-18	T-4	1,299.50	MH-5	1,299.27	Circle	18.0	Concrete	0.013	46.0	0.005	1,304.50	1,305.65	3.20	1,304.34	1,304.30	1.81
P-19	CB-11	1,299.48	MH-5	1,299.37	Circle	18.0	Concrete	0.013	22.0	0.005	1,304.98	1,305.65	1.06	1,304.33	1,304.32	0.60
P-20	MH-5	1,299.17	T-5	1,298.92	Circle	18.0	Concrete	0.013	49.5	0.005	1,305.65	1,306.29	3.95	1,304.21	1,304.14	2.23
P-21	T-5	1,298.92	CB-12	1,298.73	Circle	18.0	Concrete	0.013	47.5	0.004	1,306.29	1,306.22	5.92	1,303.98	1,303.83	3.35
P-22	CB-12	1,298.73	CB-13	1,298.25	Circle	18.0	Concrete	0.013	118.0	0.004	1,306.22	1,306.01	6.60	1,303.67	1,303.21	3.73
P-23	CB-13	1,298.25	T-6	1,298.14	Circle	18.0	Concrete	0.013	28.0	0.004	1,306.01	1,305.84	8.10	1,302.95	1,302.78	4.58
P-24	CB-14	1,299.09	CB-15	1,298.67	Circle	18.0	Concrete	0.013	84.5	0.005	1,305.68	1,305.68	0.77	1,302.81	1,302.81	0.44
P-25	CB-15	1,298.67	T-6	1,298.14	Circle	18.0	Concrete	0.013	105.5	0.005	1,305.68	1,305.84	1.32	1,302.80	1,302.78	0.75
P-26	T-6	1,298.14	T-7	1,297.99	Circle	18.0	Concrete	0.013	38.0	0.004	1,305.84	1,305.74	9.22	1,302.78	1,302.49	5.22
P-27	CB-16	1,298.09	T-7	1,297.99	Circle	18.0	Concrete	0.013	19.5	0.005	1,304.89	1,305.74	1.31	1,302.74	1,302.74	0.74
P-28	T-7	1,297.99	MH-6	1,297.87	Circle	18.0	Concrete	0.013	28.5	0.004	1,305.74	1,305.66	12.14	1,301.81	1,301.43	6.87
P-29	MH-6	1,297.77	MH-21	1,297.31	Circle	18.0	Concrete	0.013	117.0	0.004	1,305.66	1,305.43	12.11	1,300.78	1,299.23	6.85
P-30	CB-17	1,300.39	T-8	1,300.28	Circle	18.0	Concrete	0.013	22.0	0.005	1,305.92	1,305.68	0.91	1,301.20	1,301.20	0.87
P-31	CB-18	1,300.53	T-8	1,300.28	Circle	18.0	Concrete	0.013	50.5	0.005	1,305.92	1,305.68	0.80	1,301.20	1,301.20	0.87
P-32	T-8	1,300.28	T-9	1,299.92	Circle	18.0	Concrete	0.013	73.0	0.005	1,305.68	1,305.42	1.63	1,301.20	1,301.19	1.22
P-33	CB-19	1,300.17	T-9	1,299.92	Circle	18.0	Concrete	0.013	50.5	0.005	1,305.92	1,305.42	0.80	1,301.20	1,301.19	0.56
P-34	T-9	1,299.92	T-10	1,299.82	Circle	18.0	Concrete	0.013	18.5	0.005	1,305.42	1,305.30	2.27	1,301.19	1,301.19	1.38
P-35	CB-20	1,299.89	T-10	1,299.82	Circle	18.0	Concrete	0.013	13.5	0.005	1,305.92	1,305.30	2.55	1,301.19	1,301.19	1.54
P-36	T-10	1,299.82	MH-7	1,299.22	Circle	18.0	Concrete	0.013	120.5	0.005	1,305.30	1,305.34	4.53	1,300.67	1,300.42	3.69
P-37	MH-7	1,299.12	T-11	1,299.02	Circle	18.0	Concrete	0.013	20.5	0.005	1,305.34	1,305.23	4.39	1,300.31	1,300.29	2.84
P-38	CB-21	1,299.08	T-11	1,299.02	Circle	18.0	Concrete	0.013	12.5	0.005	1,305.92	1,305.23	0.97	1,300.29	1,300.29	0.62
P-39	T-11	1,299.02	MH-20	1,298.72	Circle	18.0	Concrete	0.013	59.5	0.005	1,305.23	1,305.03	5.20	1,300.29	1,300.19	3.11
P-40	CB-22	1,304.41	T-12	1,304.05	Circle	18.0	Concrete	0.013	90.0	0.004	1,308.32	1,308.03	0.46	1,305.58	1,305.58	0.29
P-41	CB-23	1,304.19	T-12	1,304.05	Circle	18.0	Concrete	0.013	28.0	0.005						

Label	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Section Type	Diameter (in)	Material	Manning's n	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Flow (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Velocity (ft/s)
P-50	MH-11	1,302.27	T-14	1,302.23	Circle	24.0	Concrete	0.013	11.0	0.004	1,308.07	1,308.09	7.70	1,304.82	1,304.81	2.44
P-51	T-14	1,302.23	CB-27	1,301.91	Circle	24.0	Concrete	0.013	80.5	0.004	1,308.09	1,308.15	9.72	1,304.81	1,304.66	3.08
P-52	CB-27	1,301.91	T-15	1,301.86	Circle	24.0	Concrete	0.013	11.5	0.004	1,308.15	1,307.96	10.86	1,304.53	1,304.50	3.44
P-53	T-15	1,301.86	T-18	1,301.34	Circle	24.0	Concrete	0.013	130.5	0.004	1,307.96	1,307.03	12.65	1,304.50	1,304.10	4.01
P-54	CB-29	1,302.89	T-16	1,302.61	Circle	18.0	Concrete	0.013	55.0	0.005	1,306.81	1,307.31	1.25	1,304.62	1,304.61	0.71
P-55	CB-28	1,302.72	T-16	1,302.61	Circle	18.0	Concrete	0.013	37.0	0.003	1,306.74	1,307.31	0.51	1,304.61	1,304.61	0.29
P-56	T-16	1,302.61	T-17	1,302.58	Circle	18.0	Concrete	0.013	9.0	0.003	1,307.31	1,307.31	1.58	1,304.61	1,304.61	0.90
P-57	CB-30	1,302.77	T-17	1,302.58	Circle	18.0	Concrete	0.013	38.0	0.005	1,305.94	1,307.31	3.14	1,304.64	1,304.61	1.77
P-58	T-17	1,302.58	MH-12	1,302.45	Circle	18.0	Concrete	0.013	45.5	0.003	1,307.31	1,307.13	4.36	1,304.61	1,304.53	2.47
P-59	MH-12	1,302.35	T-18	1,301.84	Circle	18.0	Concrete	0.013	170.0	0.003	1,307.13	1,307.03	4.29	1,304.48	1,304.19	2.43
P-60	T-18	1,301.34	MH-13	1,301.21	Circle	24.0	Concrete	0.013	31.0	0.004	1,307.03	1,306.38	15.45	1,303.73	1,303.58	4.91
P-61	CB-31	1,301.77	MH-13	1,301.74	Circle	18.0	Concrete	0.013	5.0	0.006	1,306.38	1,306.38	2.02	1,303.80	1,303.80	1.14
P-62	MH-13	1,300.71	T-19	1,300.43	Circle	30.0	Concrete	0.013	71.5	0.004	1,306.38	1,306.28	16.68	1,303.58	1,303.46	3.39
P-63	T-19	1,300.43	CB-32	1,300.23	Circle	30.0	Concrete	0.013	50.5	0.004	1,306.28	1,306.49	19.17	1,303.28	1,303.17	3.90
P-64	CB-32	1,300.23	T-20	1,299.89	Circle	30.0	Concrete	0.013	84.5	0.004	1,306.49	1,306.60	19.81	1,303.01	1,302.82	4.03
P-65	T-20	1,299.89	T-21	1,299.65	Circle	30.0	Concrete	0.013	59.5	0.004	1,306.60	1,306.10	20.52	1,302.64	1,302.50	4.17
P-66	T-21	1,299.65	T-22	1,299.53	Circle	30.0	Concrete	0.013	30.5	0.004	1,306.10	1,305.75	21.35	1,302.50	1,302.41	4.34
P-67	T-22	1,299.53	CB-33	1,299.33	Circle	30.0	Concrete	0.013	50.5	0.004	1,305.75	1,305.96	22.93	1,302.18	1,302.03	4.66
P-68	CB-33	1,299.33	MH-18	1,299.31	Circle	30.0	Concrete	0.013	5.0	0.004	1,305.96	1,305.98	27.28	1,301.51	1,301.49	5.99
P-69	MH-14	1,299.60	MH-15	1,299.58	Circle	24.0	Concrete	0.013	7.0	0.003	1,303.10	1,303.10	15.89	1,302.34	1,302.31	5.06
P-70	MH-15	1,299.48	MH-16	1,299.24	Circle	24.0	Concrete	0.013	80.0	0.003	1,303.10	1,306.21	15.87	1,301.82	1,301.43	5.05
P-71	MH-16	1,298.74	MH-17	1,298.56	Circle	30.0	Concrete	0.013	57.5	0.003	1,306.21	1,306.87	15.67	1,301.37	1,301.29	3.19
P-72	MH-17	1,298.46	MH-18	1,298.32	Circle	30.0	Concrete	0.013	47.0	0.003	1,306.87	1,305.98	15.44	1,301.12	1,301.05	3.14
P-73	MH-18	1,297.32	MH-19	1,297.14	Circle	42.0	Concrete	0.013	58.0	0.003	1,305.98	1,305.23	36.90	1,300.77	1,300.69	3.83
P-74	MH-19	1,296.64	T-23	1,296.55	Circle	48.0	Concrete	0.013	29.5	0.003	1,305.23	1,305.20	36.69	1,300.63	1,300.61	2.92
P-75	T-23	1,296.55	CB-35	1,296.22	Circle	48.0	Concrete	0.013	112.0	0.003	1,305.20	1,305.16	38.05	1,300.61	1,300.53	3.02
P-78	CB-35	1,296.12	T-24	1,296.00	Circle	48.0	Concrete	0.013	73.0	0.002	1,305.16	1,305.12	38.33	1,300.44	1,300.39	3.05
P-79	T-24	1,296.00	CB-36	1,295.94	Circle	48.0	Concrete	0.013	18.0	0.003	1,305.12	1,305.07	39.44	1,300.29	1,300.28	3.13
P-80	CB-36	1,295.94	MH-20	1,295.92	Circle	48.0	Concrete	0.013	9.0	0.002	1,305.07	1,305.03	40.11	1,300.18	1,300.17	3.19
P-81	MH-20	1,295.82	T-25	1,295.64	Circle	48.0	Concrete	0.013	59.5	0.003	1,305.03	1,304.98	43.58	1,300.03	1,299.98	3.46
P-82	T-25	1,295.64	T-26	1,295.55	Circle	48.0	Concrete	0.013	30.0	0.003	1,304.98	1,304.98	43.76	1,299.98	1,299.95	3.48
P-83	CB-37	1,298.65	T-26	1,298.05	Circle	18.0	Concrete	0.013	121.0	0.005	1,305.00	1,304.98	0.89	1,300.07	1,300.06	0.51
P-84	T-26	1,295.55	CB-38	1,295.45	Circle	48.0	Concrete	0.013	32.0	0.003	1,304.98	1,305.19	44.13	1,299.83	1,299.80	3.51
P-85	CB-38	1,295.45	MH-21	1,294.81	Circle	48.0	Concrete	0.013	140.5	0.005	1,305.19	1,305.43	44.76	1,299.68	1,299.55	3.56
P-86	MH-21	1,294.31	CB-39	1,294.23	Circle	54.0	Concrete	0.013	16.0	0.005	1,305.43	1,304.43	53.85	1,299.44	1,299.43	3.38
P-87	CB-39	1,294.13	CB-40	1,293.69	Circle	54.0	Concrete	0.013	88.5	0.005	1,304.43	1,304.43	55.82	1,299.30	1,299.23	3.50
P-88	CB-40	1,293.59	T-27	1,293.52	Circle	54.0	Concrete	0.013	14.5	0.005	1,304.43	1,304.43	57.69	1,299.10	1,299.09	3.62
P-89	T-27	1,293.52	MH-22	1,293.21	Circle	54.0	Concrete	0.013	61.5	0.005	1,304.43	1,303.42	58.08	1,299.09	1,299.04	3.65
P-90	MH-22	1,293.11	MH-23	1,292.46	Circle	54.0	Concrete	0.013	130.0	0.005	1,303.42	1,301.51	99.52	1,298.11	1,297.78	6.25
P-91	MH-23	1,292.36	AQUASWIRL	1,291.07	Circle	54.0	Concrete	0.013	258.4	0.005	1,301.51	1,302.19	98.67	1,295.53	1,295.28	7.30
P-92	AQUASWIRL	1,														

## IndianBndBoxSD.stsw



IndianBndBoxSD.stsw



FlexTable: Headwall Table

IndianBndBoxSD.stsw

Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Flow (Known) (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
H-1	1,305.00	1,294.30	764.00	1,297.02	1,297.02

FlexTable: Conduit Table

IndianBndBoxSD.stsw

Label	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Section Type	Number of Barrels	Rise (ft)	Span (ft)	Material	Manning's n	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Flow (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Velocity (ft/s)
70thSt-SctsdleRd-Box_Proposed	Box_Connect-1	1,292.83	Box_Connect-2	1,290.60	Box	2	6.0	12.0	Concrete	0.013	956.0	0.002	1,304.50	1,300.56	764.00	1,296.26	1,293.78	9.29
PalmeraieBlvdBoxExst	H-1	1,294.30	Box_Connect-1	1,293.83	Box	3	5.0	10.0	Concrete	0.013	140.0	0.003	1,305.00	1,304.50	764.00	1,297.02	1,296.49	9.57
SctsdleBoxExst	Box_Connect-2	1,290.60	Outfall_RRPark	1,290.21	Box	3	6.0	10.0	Concrete	0.013	129.0	0.003	1,300.56	1,300.00	764.00	1,293.68	1,293.64	9.23

FlexTable: Transition Table

IndianBndBoxSD.stsw

Label	Elevation (Ground) (ft)	Elevation (Top) (ft)	Elevation (Invert) (ft)	Transition Length (ft)	Flow (Total Out) (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
Box_Connect-1	1,304.50	1,298.83	1,292.83	5.0	764.00	1,296.26	1,296.26
Box_Connect-2	1,300.56	1,300.56	1,290.60	5.0	764.00	1,293.78	1,293.68

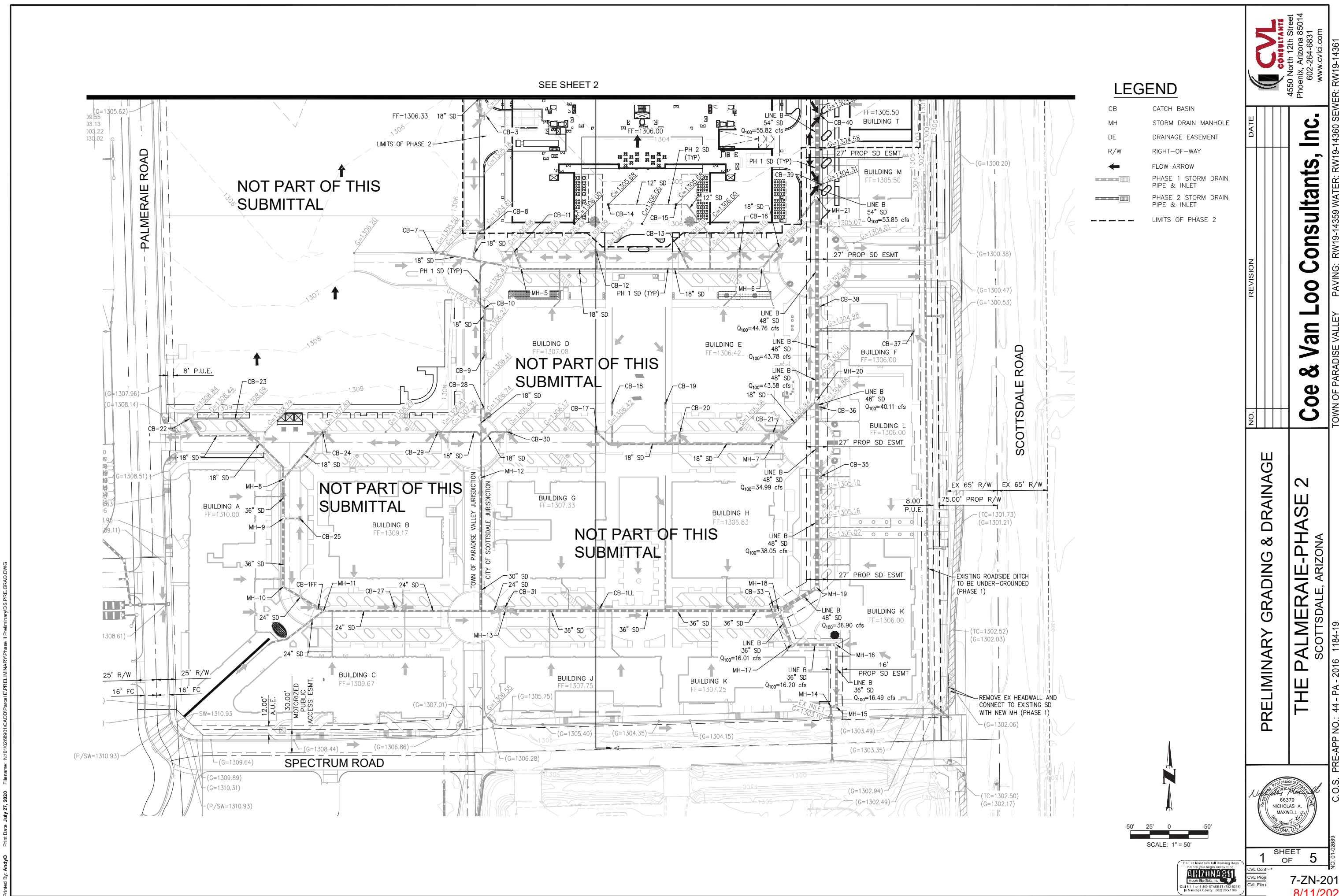
### FlexTable: Outfall Table

IndianBndBoxSD.stsw

Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Hydraulic Grade (ft)	Flow (Total Out) (cfs)
Outfall_RRPark	1,300.00	1,290.21	User Defined Tailwater	1,293.64	764.00

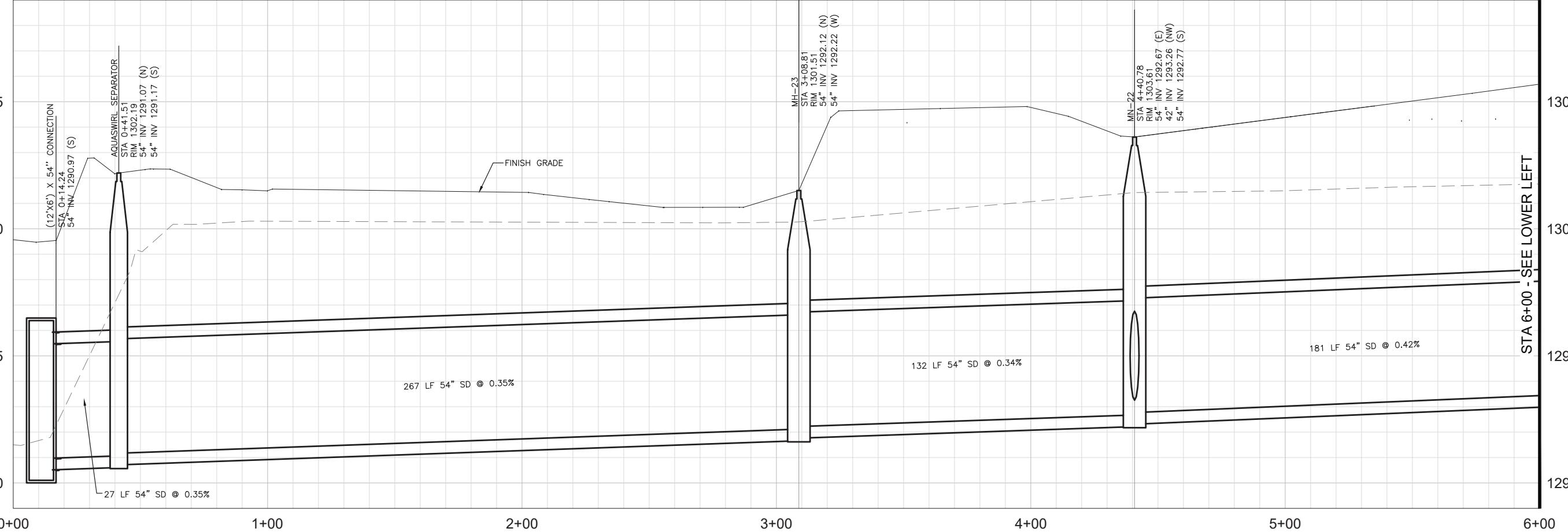
## **APPENDIX E**

### **Preliminary Grading & Drainage Plans**



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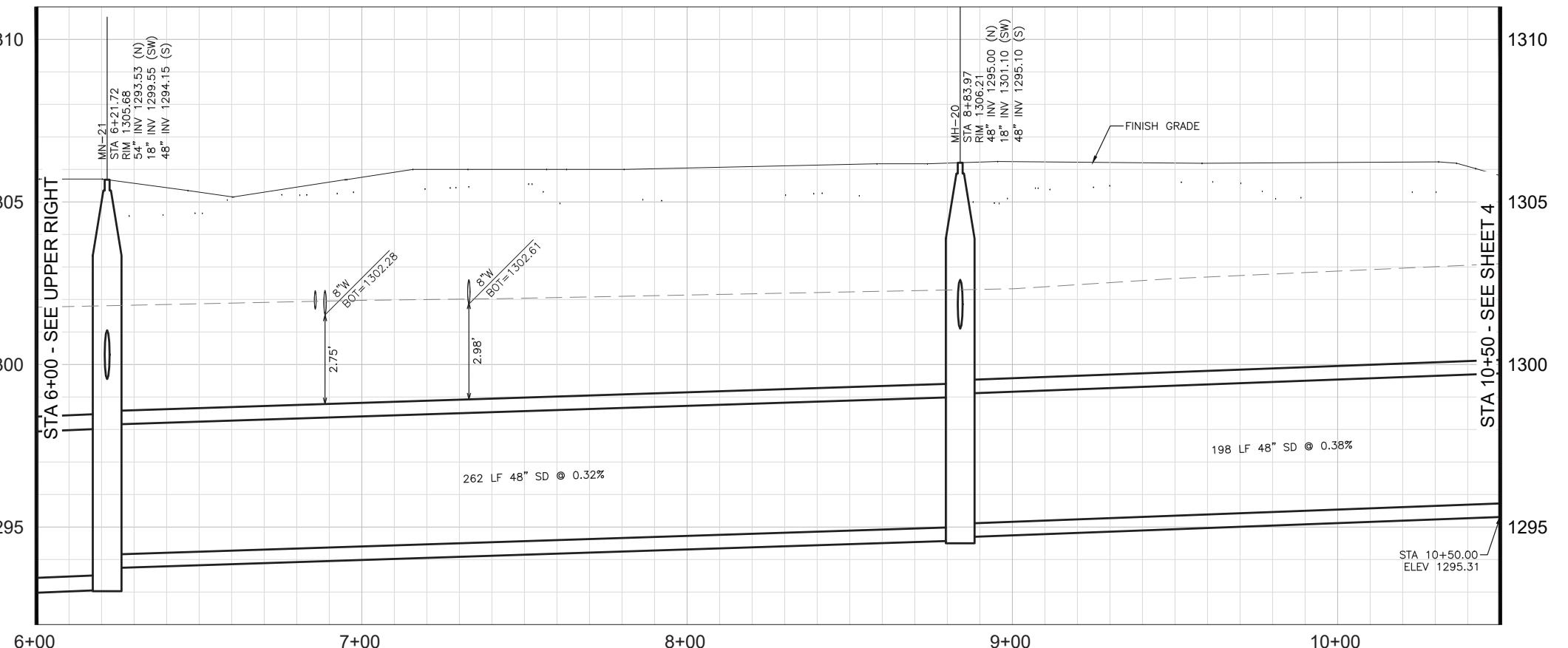
**PRELIMINARY STORM DRAIN PLAN**



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NO. 01-02688

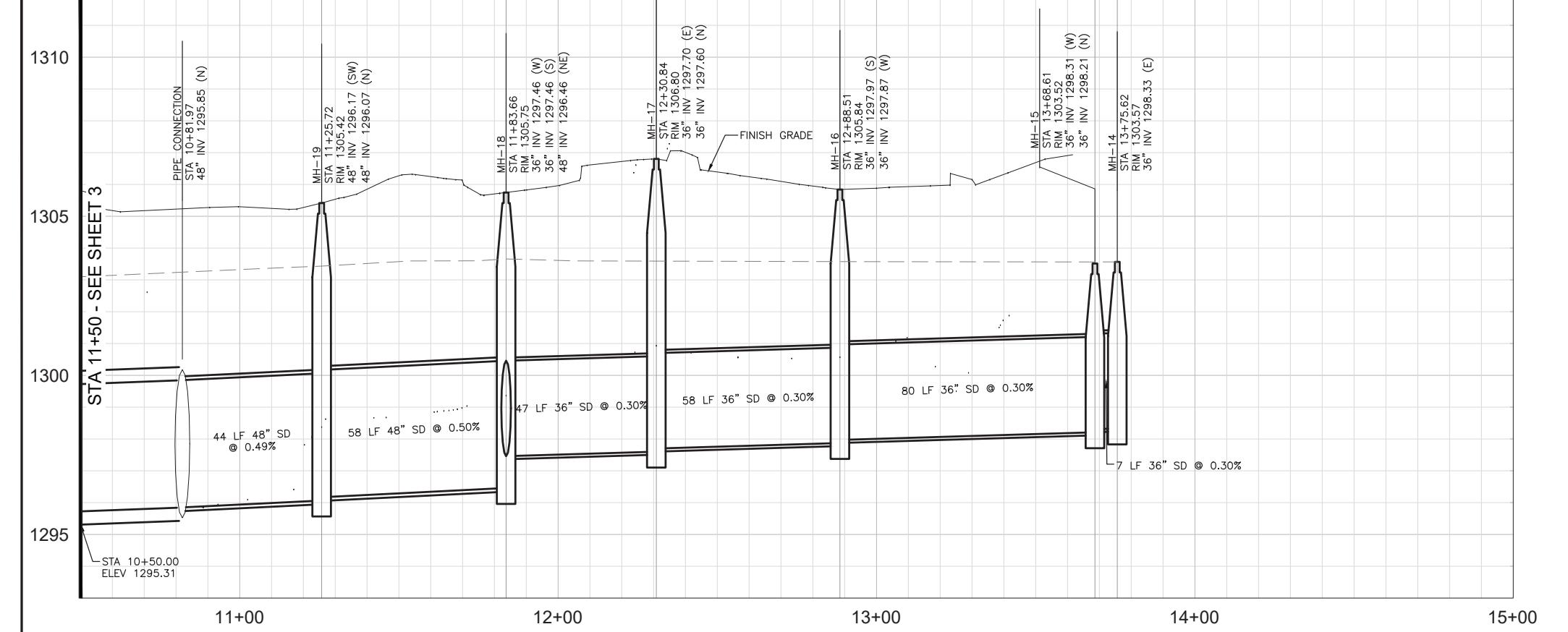
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7-ZN-2016#2  
8/11/2020



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DATE	DATE	DATE
REVISION	REVISION	REVISION
NO.	NO.	NO.

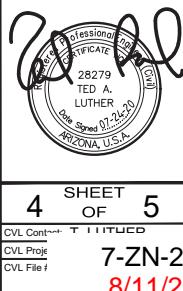
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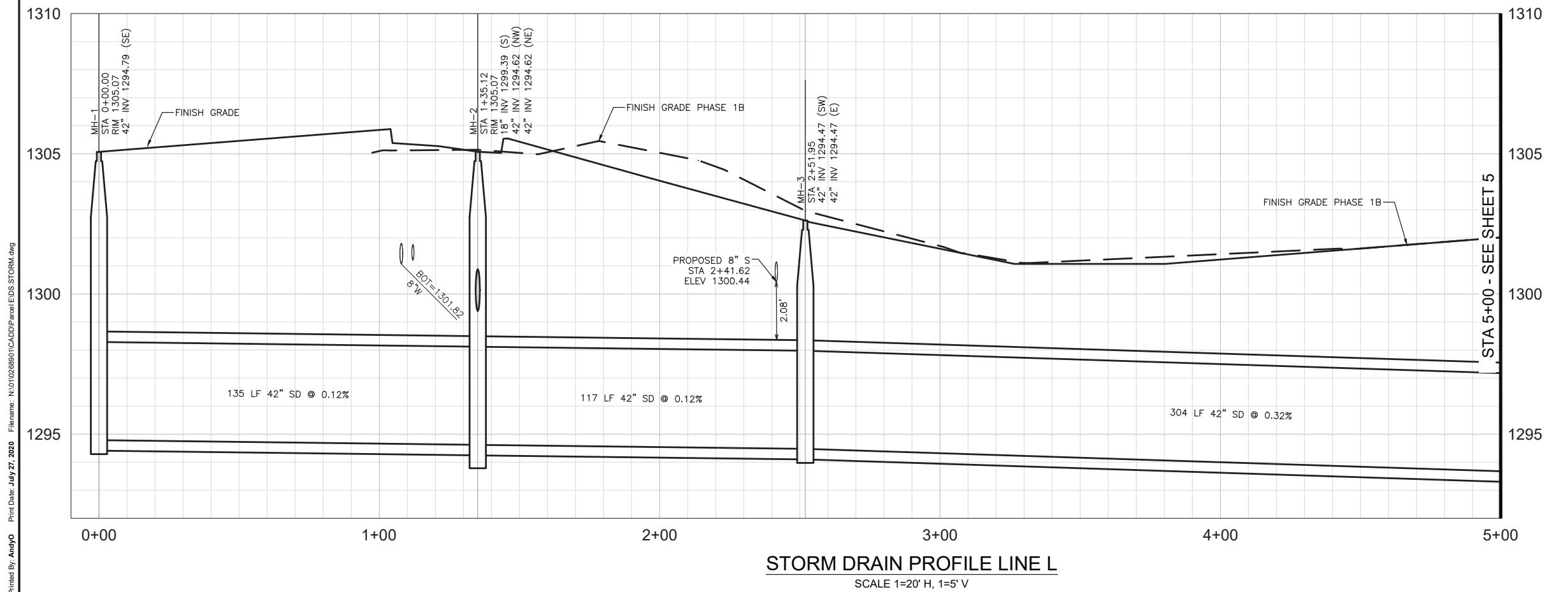
**PHASE 1A PRELIMINARY STORM DRAIN PLAN**

**THE PALMERAIE**  
SCOTTSDALE, ARIZONA



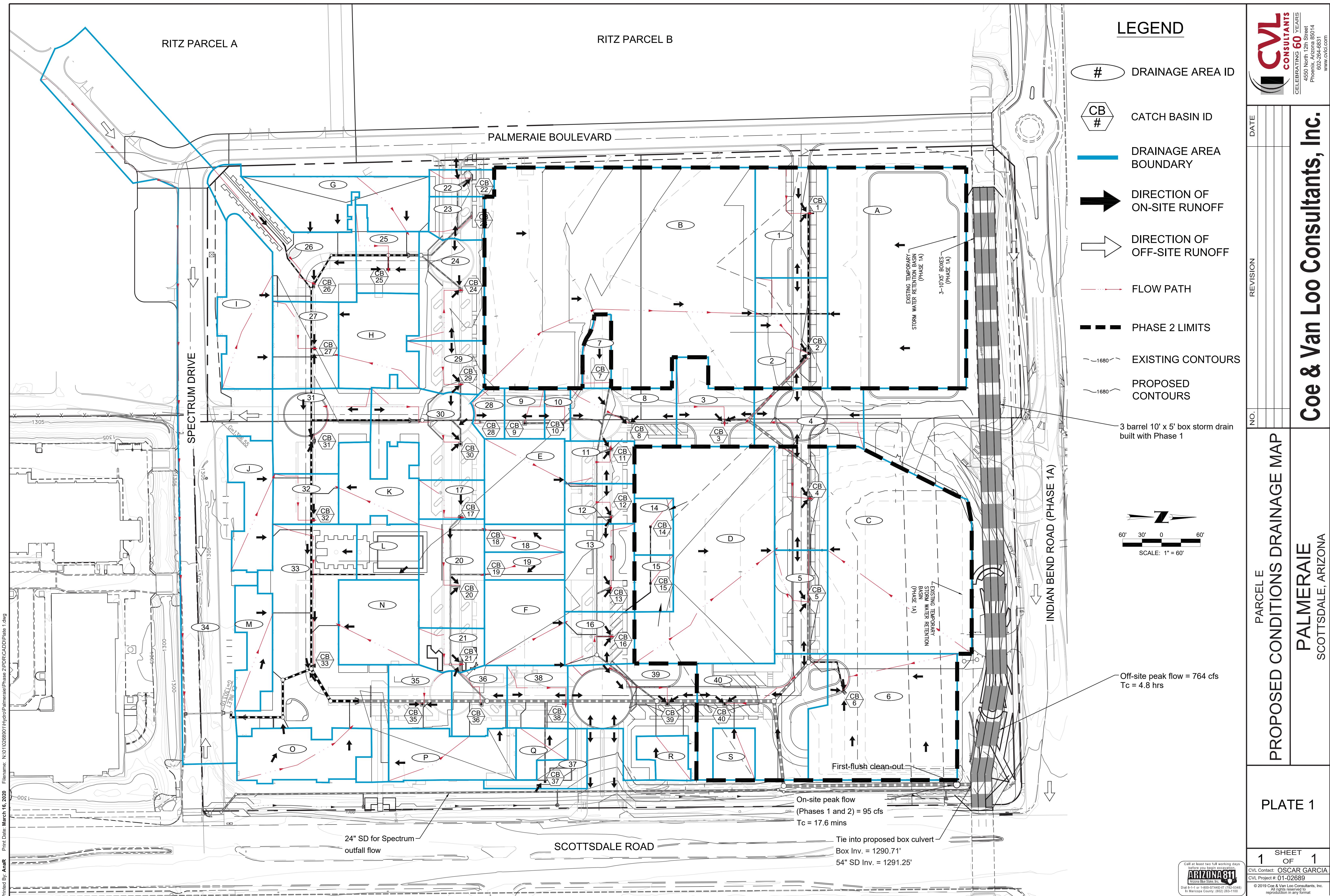
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# **PLATES**



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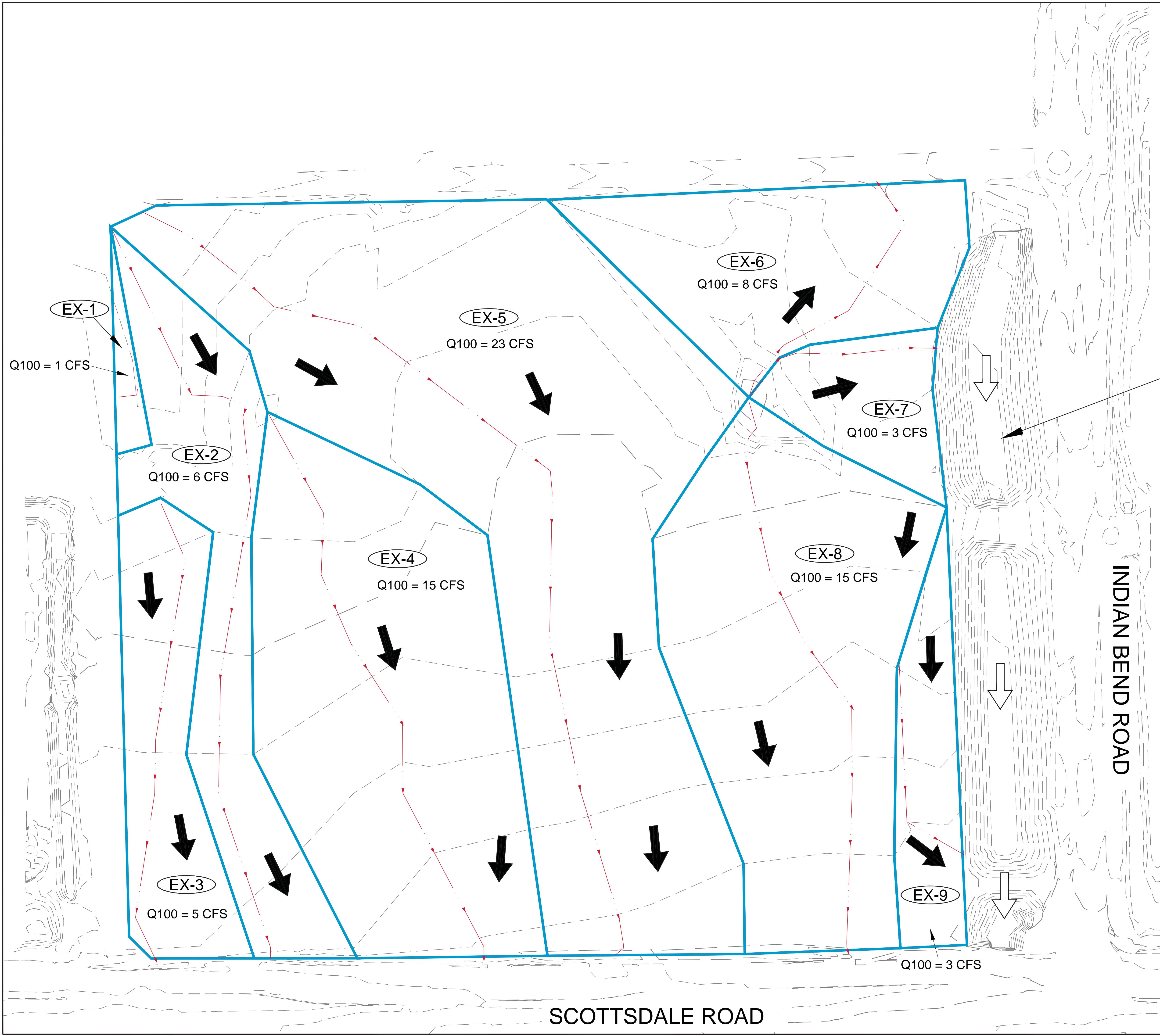
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# PALMERAIE

SCOTTSDALE, ARIZONA

PAGE 1

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**LEGEND**

- (EX-#) DRAINAGE AREA ID
- DRAINAGE AREA BOUNDARY
- DIRECTION OF ON-SITE RUNOFF
- ↗ DIRECTION OF OFF-SITE RUNOFF
- FLOW PATH